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Electric or Coke Heating ?

An uninformative comparison

THE paper entitled "A Comparison of the Costs of Heat Supply by Electrode Boiler or by Coke Boiler to the Same Group of Buildings," which was presented to the Institute of Fuel by Drs. S. Livingstone Smith and C. H. Lander last week, represents yet another attack on the position that electric thermal storage heating has established for itself during the past few years. There is, however, no need to be alarmed. Electric heating has suffered many such an attack in the past and has successfully weathered worse storms than this.

The group of buildings in question are the Union Buildings at the Imperial College of Science, South Kensington, which were heated in 1929 by an electric thermal storage heating plant, and the Fuel Technology building which was heated by steam from an Office of Works boiler plant. In 1934 the steam supply to the latter building was discontinued and, as the thermal storage plant was not large enough to deal with the additional load, two magazine-type coke boilers were coupled up to the electric thermal storage system and the entire group of buildings was heated by this combination of coke boilers, electrode boiler and thermal storage equipment.

The title of the paper led one to expect some valuable information on the relative value of coke and electricity for building heating, but this expectation was not realised. A more correct title would have been "The cost of heating a group of buildings by a combination of coke boilers, electrode boiler and thermal storage," because, as the paper itself discloses, neither the electrode boiler nor the coke boilers are capable of dealing with the total heating load. Shorn of its elaborate trimmings, the paper proves merely that on an extended test 74.6 per cent. of the heat supplied to the boilers as coke was transferred to the water leaving the boilers! The mountain of scientific effort has laboured and, after many groanings, has produced this mouse of information—information that was known to all of us many years ago.

One is tempted to ask: What was the idea behind this paper? If it presents only the results of measured tests, why this disclaimer of bias? There is little doubt in our mind that its real purpose lies, not in the ascertained results, but in the final conclusions drawn from those results. The authors conclude that, as they obtained the efficiency stated above, they are entitled to assume that without the aid of thermal storage or electrode boiler they can usefully employ 74.6 per cent. of the heat value of the coke used in the boilers for heating the building. Surely a rather rash assumption. They make use of the thermal storage plant and the electrode boiler for obtaining a high efficiency and yet do not debit the coke plant with the capital charges on the equipment which enables that efficiency to be obtained.

This, however, is not the whole of the story by any manner of means. In this installation, coke with a calorific value of 12,900 B.th.u. per lb. and a moisture content of 0.9 per cent. is supplied for from 32s. to 33s. 8d. per ton, although inquiries show that the general price obtaining in London to-day is more like 40s. per ton for coke with a calorific value of 12,400 B.th.u. per lb. and a moisture content of 5 per cent. Another rather staggering fact is that the labour costs of the electrical plant are greater than those of the coke boilers. It is not, of course, suggested that in this particular installation the facts are other than as stated by the authors, but they give no hint that any of these facts are the least bit unusual.

There is little need to point out here that the justification for electric heating lies not in the amount of heat that can be generated by electricity as compared with coke, but in the fact that a much greater proportion of the heat generated can be usefully employed for heating the building. The authors of the paper have taken no steps whatever to investigate this all-important question. As an experiment on a unique heating installation the paper has some limited interest; as a contribution to the fund of knowledge available for

the guidance of those engaged in dealing with heating problems it contributes nothing.

If this paper was intended to strike the death-knell of electric heating it has failed signally in its purpose, as no one who was present at the discussion could fail to realise. It is not the first time that this particular installation has been used in an effort to discredit electric heating. It formed the subject of a booklet by the Gas Light and Coke Co. in 1934, and was one of the main arguments against electric heating in a paper on the utilisation of coke for building heating in 1935. May we suggest that, as a weapon, it has become a little blunted? Are there no other coke-fired heating installations?

Selling Cold

The selling of refrigerators, particularly of the commercial type, requires salesmen with a special technique, and the methods adopted by Edmundsons, where the general salesmen prepare the way for specialists whom the company employs, deserves special consideration. The importance of the backing of a fully qualified and equipped technical service staff cannot be over-estimated. As Mr. MacDonald points out in his article in this issue, that is one of the first questions raised by the prospective purchaser of a commercial unit. In most cases it is almost essential that the servicing should be done locally by the installing contractor or supply undertaking. Progress in both the domestic and commercial fields is encouraging, and the fact that supply undertakings generally are realising the benefits of what is mainly an off-peak load is a good sign.

The "Baby" Refrigerator

Is the 2-cu. ft. refrigerator adequate? That is a knotty problem for manufacturers and supply undertakings. It is in its favour that the "baby" refrigerator can be bought for 22 gns. and hire-purchased for 2s. a week for five years in direct competition with its gas rival, which is sold at 1s. 11d. a week for six years—a sufficiently small sum to open an almost untapped market. But when clients become properly "refrigerator minded" they may consider it much too small. While the 2-cu. ft. size offers an attraction to those with low incomes, the salesman should ensure that the customer buys, if he can possibly afford it, a 3-cu. ft. size, the manufacturing costs of which are so little different that it can be sold for 25 gns. But better to sell a "baby" than none at all.

Air Conditioning

We agree, of course, with Mr. T. S. Jones, a letter from whom appears in this issue, that the electric drive is better in every way than any other, but even for this duty electricity has not the field entirely to itself. As an example, we may cite the case of the recently built Cumberland Hotel, W., where many of the main drives are by specially designed reciprocating steam engines of about 5 h.p. each, which act as reducing valves and pass on process steam. The point is that, as Mr. E. M. Ackery stated in his article last week, the assumption that electricity has no competitor in the air-conditioning field is very far from the truth, and that if charges for electricity are too high some other form of power drive may be adopted. Complacency is particularly inadmissible in regard to air conditioning.

Smoke and Grit

Included in the "Report on the Investigation of Atmospheric Pollution" for the year ended March 31st are three recommendations of a committee of the bodies co-operating with the Department of Scientific and Industrial Research. These are in brief: (1) that local authorities should use washed coal in their own works and should press industrialists in their areas to do the same; (2) that means of access should be provided to the flues of new boilers for making reliable measurements of grit both before and after passing extractors; (3) that research in grit-extraction methods should be accelerated, especially for small boiler installations. In the first case, it is to be hoped that the method of "pressing" industrialists will take the form of offering attractive terms for the use of electricity, whenever applicable. As to the second, the Ministry of Health holds that the time has not arrived to frame a model by-law. The position would appear to be much the same as it was in 1932, when the committee on power-station emissions found itself unable to recommend any particular system of testing. No conclusion was reached by the conference of co-operating bodies regarding action to be taken on the third recommendation of the committee. Hesitation was largely on a question of finance, but here again the best way of improving the position is often by electrification.

Registered Contractors

The National Register of Electrical Installation Contractors appears to have reached the crest of the wave—the point at which its revenue is likely to decline while expenses increase, unless something is done. The Register's principal activity now is the inspection of installations, both those of contractors already registered (to keep them up to standard) and those of applicants for registration. This absorbs about half of the income and actually in the case of rejected applicants there is a loss of over £3 on an inspection. At present the Register retains only £2 of a rejected applicant's £5 fee; it is suggested that the whole shall be kept. Another proposal is that canvassing should be intensified to ensure a better inflow of applications. As the number of contractors on the Register is only 1,723, while the number of contractors is variously estimated at between ten and twelve thousand, at least half of whom should be "registrable," there appears to be plenty of scope.

Appliances for Export

The rapid increase in domestic electrical development in this country has no doubt been largely due to the attractive designs of electrical appliances which manufacturers have placed upon the market, and their success has been such, perhaps, as to encourage manufacturers to neglect the export market. In his speech at the annual meeting of the Associated Electrical Industries, Ltd., on Friday last, Sir Felix Pole mentioned that during his visit to South Africa he found that the proportion of British appliances sold was very small, despite the desire of the Union to buy British. Appliances which had found favour here were said to be unattractive overseas, and he thought that we needed to carefully review our designs of household electrical appliances. It is to be hoped that manufacturers will take note of this observation, for this field is a rapidly expanding one and would seem well worth their closer attention.

A.R.P. and Lighting

In view of the importance attached to the control of street lighting in connection with air-raid precautions, the notes on the subject in E.D.A.'s new publication "Electric Street Lighting" should interest local administrators. Extinction in an emergency will be the easier as the proportion of electric lamps advances from its present 55 per cent. of the total in Great Britain. That rapid progress may be expected is indicated by returns available during the past five years from 143 of the most important undertakings. These show that the number of electric lamps in these areas has increased by 62 per cent. since 1933. As there has been a reduction of only 8.9 per cent. in the number of gas lamps within that time, this means a considerable increase in the mileage of roads lighted that previously were in darkness. Indeed, it is estimated that 60 per cent. of the new lamps have been installed for this purpose. This additional lighting was badly enough needed, but it would have complicated air-raid precautions if electric lamps were not so easily and immediately controllable.

Electrical——
——Refrigeration

Progress on the selling side

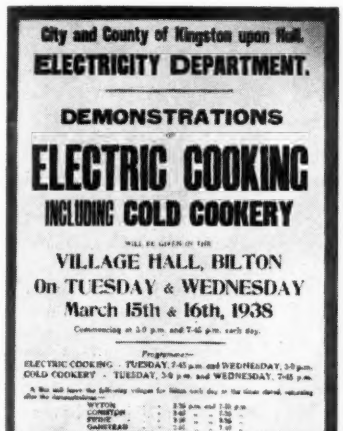
THERE is a strong tendency to-day for refrigerators, as with motor cars, to be sold on their appearance and special features. Actual design, from the technical standpoint, has undergone practically no radical change of any kind. Improvements in efficiency have been made, bringing about more economical running, but no one is going to grumble at the runninp cost, at least with the compressor type, as this is less than a kWh a day.

Gas publicity, at a time when the electrical industry had yet to realise the benefits to be derived from refrigeration, resulted in large sales of gas-heated absorption-type refrigerators, the running cost of which is approximately £2 18s. a year, as compared with £1 9s. for an electrical model of the same size, *viz.*, 4 cu. ft. (electricity at 1d. per kWh; gas at 8.6d. per therm). This year the gas effort is to reduce the hire-purchase charge to 1s. 11d. a week for six years—for a 2¼ cu. ft. size. For the same size model many electricity undertakings charge only 2s. a week for five years.

The old argument of silence and reliability of the absorption type no longer carries much weight, since hermetically sealed compressor units have come to the fore. There is a welcome sign that manufacturers realise that there is a big potential demand for a low-priced equipment of about 2¼ cu. ft. without any "trimmings" and gadgets, *i.e.*, a purely utility model. Several are, in fact, offered for 22 gn., as well as a well-known make of 3¼ cu. ft. for 25 gn. Where space is at a premium there is now a small built-in model for 15 gn.

Last year's sales were not generally in excess of those for 1936, but considering the coolness of the summer the drop was very small and some undertakings and manufacturers reported a big increase. The supply undertakings are really becoming alive to the value of the refrigerator as a means of filling the valley in the summer load curve. There are no official figures of refrigerators connected, but a rough estimate is 200,000; these may take on an average 400 kWh a year, making 8,000,000 kWh altogether—no mean load.

Messrs. Pinkney & Ryan, in the paper which they read at the 1937 I.M.E.A. Convention, estimated the additional energy consumption of the domestic refrigerators sold in this country to be above 13,000,000 kWh per annum. Let us compare the annual consumption of a refrigerator with that of other domestic appliances. It is estimated that the water heater takes 2,000 kWh, the cooker 1,500 kWh, and the refrigerator next with 350 kWh, yet the annual revenue per kW of demand (including diversity) is £41, £16 and £29 respectively.



A poster drawing attention to the "cold cookery" and electric cooking demonstrations which are held alternately at Hull

Salesmanship is an important item in the disposal of refrigerators (and supply undertakings are at last taking effective steps in this direction), low hire-purchase terms are the next important step, and, finally, the introduction of the cheap "baby" refrigerator considerably enlarges the market.

Of ten undertakings from which we have received figures six report a decline and four an increase in refrigerators sold, although the totals increased from 2,554 to 2,643. Of these, four have now decided to make available five-year hire-purchase schemes of 2s. a week for the 2-2¼ cu. ft. size; this size is to be available at Southend at the unusually low rate of 1s. 6d. a week—a commendable effort. Half a crown a week is still the usual charge by supply undertakings for the 3-3½ cu. ft. size, although 2s. 3d. only is charged at Chester and Southend. The E.D.A. campaign proved helpful to many undertakings, and the fact that there was only a small increase in sales appears to have been generally due to the bad weather

[*Elec. Rev. photo.*

A North-Met. display seen at Harrow early in March

in March, April and May (usually the best selling month). This is particularly noticeable in figures supplied to us by the Croydon Corporation, where, although there was a drop from 180 to 147 over the year, there were losses only in March, April and May, but these totalled 57.

One of the first undertakings to introduce five-year hire-purchase was that at Ealing, where, incidentally, it is felt that propaganda should begin earlier in the year. Where continuous meter reading is in operation envelope stuffers, reminders, &c., should be available not later than February to make sure that consumers are ready for the warm weather in May. Both E.D.A. and some of the manufacturers seem this year to be late in announcing plans.

Posters and cold cookery demonstrations are being utilised this year; at Hull, for instance, cold cookery demonstrations are being given alternately with electric cooking demonstrations. Displays are also being arranged in twelve separate districts involving thirty-three towns and villages. A special free bus service has been organised by the Department to convey those attending from the villages in the district.

Seven days' free trial is offered at Beckenham and it has been found that less than 10 per cent. of the machines so supplied are returned except for replacement by a different model.

The effect of five-year terms is shown by the sales of the North Metropolitan Electric Power Supply Co. In 1935 these were 419 and jumped to 1,310 in 1936 when the five-year terms were introduced. Last year's figure was 1,324. At Ilford 155 refrigerators were sold last year, increasing the total on circuit from 450 to 605.

In the North-Eastern Area

Although, generally speaking, sales are much greater in the south, good progress has been made in the north. The North Eastern Electric Supply Co., Ltd., estimates that some 500 domestic refrigerators were connected to the system during the past year, the company's activities accounting for 220 sales. The number of commercial refrigerators sold during 1937 is estimated at about 25 to 30 per cent. in excess of the previous year. During the past three years the company has maintained a 50 per cent. increase in sales of domestic refrigerators and aims at an increase of 100 per cent. for 1938, the market being increased by the introduction of a 2 cu. ft. model listed at 22 gn. (2s. per week).

On the commercial side, activities of the Edmundson group will not be confined to the summer, as it is found that the "annual load factor" for refrigerator salesmen is better when employed on commercial work, where the "prospects" may require several months to make a decision on what is, in many cases, a large outlay from their capital resources. Edmundsons are introducing for the first time a 3 cu. ft. model for 2s. 6d. a week. The East Anglian Electric Supply Co., Ltd., during 1933 sold only nine machines, whereas during 1937 256 domestic models and 80 commercial units were sold in the area, although no half-a-crown a week rate was then available. The area covers 4,800 square miles, and is rural in character with two or three moderately large towns, 60 smaller towns and approximately 700 villages. There are seven speciality refrigerator salesmen and all the company's canvassers spend some time in the summer on refrigerator sales. A 2 cu. ft. model is to be introduced both by the Woking and Wimbledon undertakings.

Refrigeration—Equipment

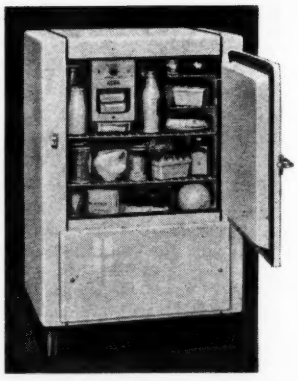
Reviewing the new domestic refrigeration equipment an outstanding feature of development is the concentration on the small models, almost every manufacturer having introduced a 2 cu. ft. size, simplicity and low price being the determining factors.

THE most popular size of refrigerator in the United States is that with a capacity of about 5 cu. ft. and for many years manufacturers concentrated on this size over here. Both on the grounds of size and price the sales of this model must necessarily be limited, and the special demands of this country have led to the introduction of 2- and 3-cu. ft. models, which have enjoyed a vogue particularly owing to the low hire-purchase terms which are available.

Little or no radical change in design has been made this year, but there is a definite concentration by manufacturers on the smaller sizes, with the introduction of several 2½ cu. ft. models at about £22 and a 3½ cu. ft. for 25 guineas, while one small machine is available for building into walls at 15 guineas. The low energy consumption and its ability to cope adequately with sudden overloads in midsummer has brought the compressor type to the fore, the only example of the absorption type now being the "Zeros" which works on the intermittent time-cycle principle. This method reduces the running cost as compared with the continuous operation machine but does not give such a high reserve of cold.

One of the most interesting of the newcomers is the new British-made "Multifrige" of the Express Refrigerating Co., Ltd., which has been added to an existing range of conventional machines and combined refrigerators and cupboards. The orthodox refrigerator has one cooling system which maintains the cabinet at a set temperature: the "Multifrige" has one master evaporator which controls the temperature in three individual compartments. The top compartment can be maintained at 30 deg. F., the lower compartment at 40 deg. and the side compartment at 50 deg., thus enabling fish, milk and butter, which require different storage temperatures, to be kept in ideal conditions. The net capacity is 14 cu. ft., there being a shelf area of 21 sq. ft. Over 80 ice cubes can be made at a time, and the outside measurements of the all-steel cabinet are 6 ft. 7 in. high by 3 ft. 6 in. wide by 1 ft. 6 in. deep. This company is also manufacturing a refrigerator combined with non-cooled cupboards.

Another newcomer among the larger sizes is the B.T.H. "PB-16" of the International Refrigerator Co., Ltd., a luxury 16 cu. ft. refrigerator embodying almost every possible refinement. The unit is hermetically sealed and has forced-draught cooling and pressure-feed lubrication with a special device which ensures that oil pressure reaches all moving parts before the motor and compressor are loaded.



The "Alba" 3-cu. ft. model

The three bottom shelves on each side of the cabinet have a sliding-drawer action giving greater accessibility, and they are mounted on special hard rubber supports. A thermometer, two vegetable containers, and a package bin are incorporated. A special tray release can also be used for releasing ice cubes two at a time and opening bottles. Twelve freezing speeds are available. A feature is a heating element between the two door openings on the outside of the cabinet, to prevent condensation of moisture. A full selection of china containers and a water jug are included. The dimensions are 5 ft. $7\frac{3}{16}$ in. high by 4 ft. 1 in. wide by 2 ft. $7\frac{9}{16}$ in. deep. Another new B.T.H. model is the 3 cu. ft. "LA-34," with an enclosed unit in the base of the cabinet, described in our issue of January 14th. Otherwise the unit is standard, being hermetically sealed.

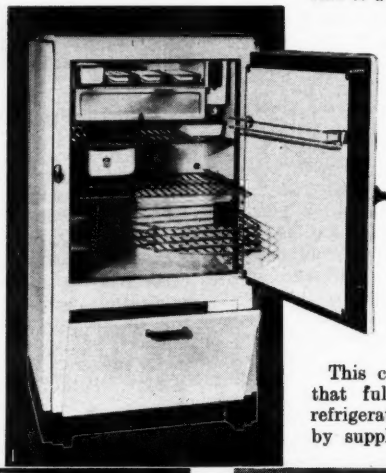
Moffats, Ltd., have added to the existing range of "M" models two new types known as the "S.46" and "S.68" with capacities of 4½ and 6½ cu. ft. with a synthetic finish known as "Duracote," in a white or ivory body and a black base. These are naturally cheaper than the standard range.

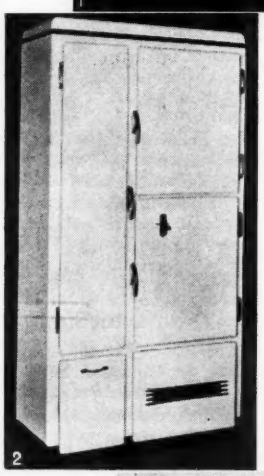
This company says that its experience has shown that full porcelain enamel is the best finish for refrigerators sold on long-term hire-purchase schemes by supply authorities, as it is a "life-time" finish on any refrigerator built in sections, and any damaged part can be quickly replaced. Regarding the compressor unit, Moffats are employing a large capacity, low-speed, reciprocating type, 350 r.p.m., V-belt driven by a "Leland" capacitor refrigerator motor. The B.T.H. and the Delco-Remy capacitor motors are optional. The "S-4" models are equipped with a very large chilling unit and a swinging basket shelf.

The "Universal" (L. G. Hawkins & Co., Ltd.) incorporates a special 'Bask-a-Dor" and a sliding shelf which pushes back to enable the container to be used on the door. This basket is easily removable so that the contents of the refrigerator can be taken out and placed on a table without several trips between table and refrigerator. Glass wool is used for the insulation and "Dulux" for the external finish for each of the four models available, which have capacities of 4, 5, 6 and 8 cu. ft. respectively.

A new addition to the range of "Prestcold" refrigerators is the "S24," a 2 cu. ft. model with a shelf area of 4½ sq. ft. The total height is 3 ft. 3⅝ in., and at the top is a porcelained lid, with a ledge to prevent articles slipping off, which can conveniently be used as a table. Apart from the lid, the exterior finish is white lacquer, porcelain being used internally. Eight freezing speeds are provided, the shelves are of the flat ribbon type, heavily tinned, and the cabinet is of all-steel construction.

A cabinet as small as 1.75 cu. ft. (the "Fridgette") is one of the Marco range of five;

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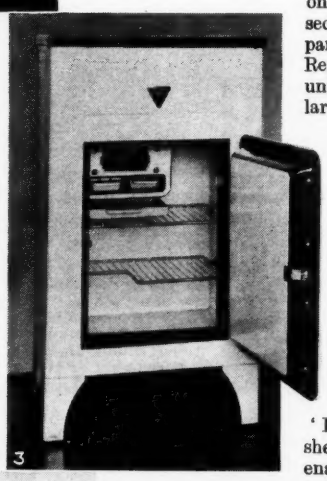
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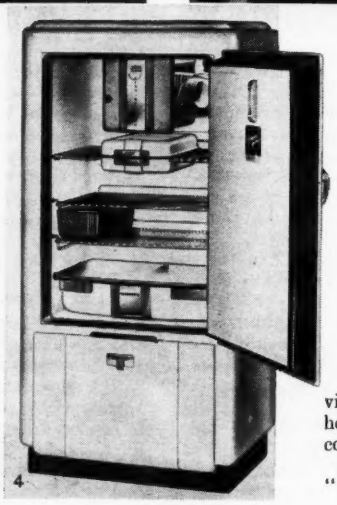
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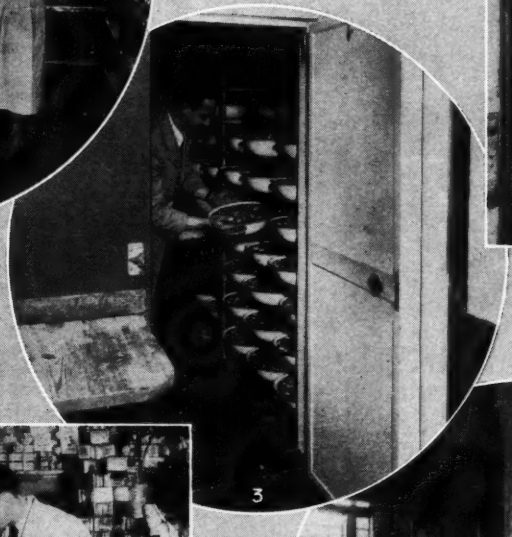
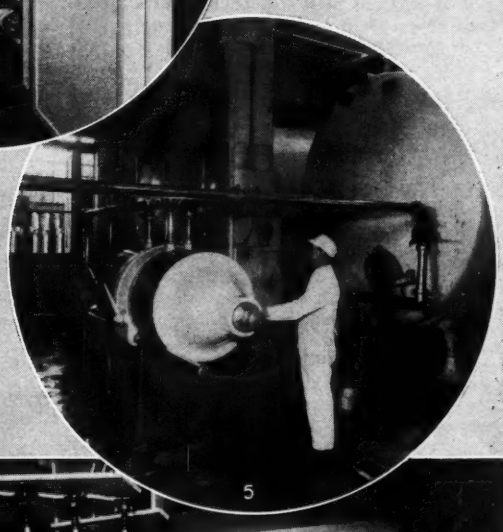
A group of new refrigerators: 1. One of the Moffat "S" series; 2. The Express "Multifrige"; 3. Prestcold 2 cu. ft. "S.24"; 4. The Westinghouse "H" model

Refrigeration in VARIOUS TRADES





Drinks 1. Electric cooling for milk storage and iced drinks installed at the "Black and White" milk bar, Coventry Street, W.1, by J. & E. Hall.

Meat 2. A meat storage room of Guttridge & Co., Central Meat Market, E.C.1, kept at a temperature of 38 to 40 deg. F. by two 10-h.p. Lightfoot-Ellarcolde motor-compressors.

Fish 3. Jellied eels kept in cold storage by A. Langley & Co., Billingsgate, by a "Prestcold" cooling outfit.

Provisions 4. Selfridge's employ a "Prestcold" refrigerated display counter for butter and provisions

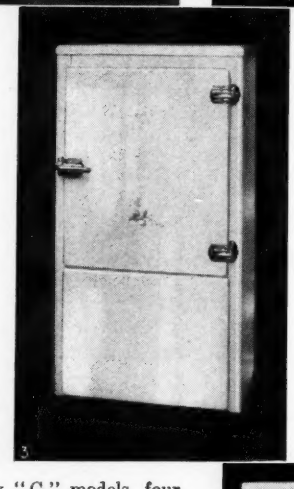
Milk 5. Milk is cooled for storage to 38 deg. at 6,000 gal. per hr. at the United Dairies Wood Lane depôt, by coolers made by the U.D. Engineering Co., Ltd.

Beer 6. Examining the temperature in the vaults of "The Sussex," Upper St. Martin's Lane, where beer is kept at 55 deg. F. by a J. & E. Hall unit *[Elec. Rev. photos.*

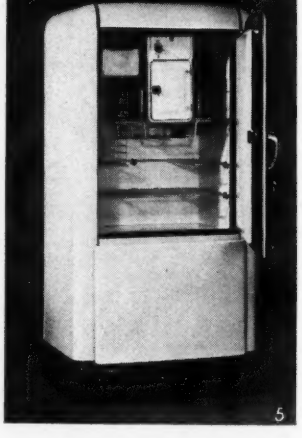
similarly to the 2 cu. ft. "Percold" model of the Coventry Refrigerator Co., Ltd., it lends itself admirably for use in flats. The "Percold" model is also sold at a very low price—in fact the lowest at which any refrigerator is obtainable, for building in. A new "Marco" model is the "C438" 3 cu. ft. general purpose model for the average household. Exclusive of any unnecessary "gadgets" it can be sold at a very competitive price.

A rather larger (4¼ cu. ft) model with a de luxe finish, and accessories, is the "D.538." The shelf area is 7 cu. ft., while the lower shelf is shaped to allow bottles to stand on the base of the cabinet. Last year's "D.837" has been modified slightly, giving a net capacity of 7 cu. ft., while an entirely new introduction is the "Carlton" for large households and boarding houses. There are two doors, one above the other, the total net capacity being 15.15 cu. ft. with a shelf area of 215 sq. ft.

The smallest Frigidaire model has hitherto been the "Master 3"; this year, however, a smaller 2 cu. ft. "Family" model has made its *début*. A feature of this little unit is the 5¼ sq. ft. of shelf area (the "Master 3" has 6½ sq. ft.), the evaporator being placed far back in the top right hand corner of the cabinet so that a shelf can be placed in front of it. A pound and a half of ice per freezing can be obtained and porcelain is used for the interior finish. Other newcomers are the "De-Luxe 8" and "Imperial 13," both of which have already been described, a feature of the former being a thermometer which can be read when the door is closed. The "Master 3" has now been made available in *de-luxe* form with additional ice storage and glass food containers.

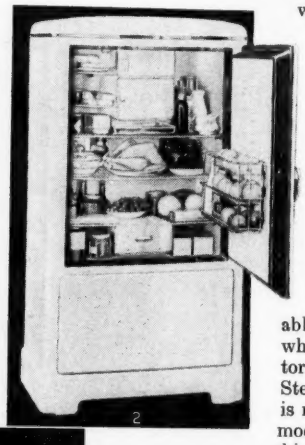


The 1938 programme of the Lightfoot Refrigeration Co., Ltd., will comprise six "G" models, four of which will be basically the same as last summer's "F" series; they are available for either a.c. or d.c. Two new models, known as type "H" are to make their appearance. These differ from the others in respect of the shelf arrangement, accessories and position of the temperature control which is situated towards the base of the cabinet, instead of at the top as hitherto. The two new models have capacities of 7.2 and 9.5 cu. ft. respectively, and special equipment on the larger model includes a new meat storage container, three covered quart china containers and two quart water servers.



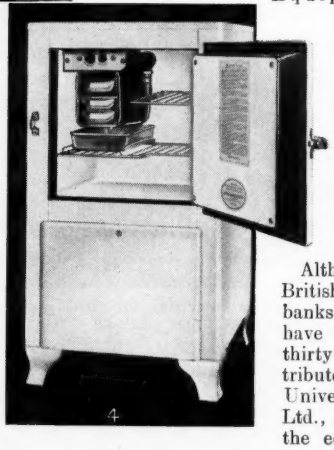
Among the 2¼ cu. ft. refrigerators is the Sparton S.228, with a shelf area of 5¼ sq. ft. and an ice-making capacity of 4.1 lb. The overall height is only 3 ft. thereby enabling the top to be utilised as a table. The Sparton Refrigerator Co.'s range also includes models rated at up to 9 cu. ft., a feature of the larger sizes being a vegetable bin in the base. Another small refrigerator of recent introduction is the "Alba" (A. J. Balcombe, Ltd.), a 3½ cu. ft. model with 6½ sq. ft. of shelf area, a porcelain interior and a direct drive compressor unit fitted with a "Delco Thermotron" motor. The "Crosley" refrigerators, sold by the same concern, are now available in *de-luxe* form with the "Electrosaver" hermetically sealed compressor unit and a new "Freezomatic" dial. Incidentally the 3 cu. ft. "Crosley" has a total shelf area of nearly 7 sq. ft.

H.M.V. Household Appliances has recently put on the market models "LTP.87" and "LTP.127" working at a much lower temperature than is usual. The appeal is limited, of course, and this type is therefore produced parallel to the standard models. It is driven by the "Silent Circulator" compressor which is of the rotary type comprising only three moving parts—the blade, roller and shaft. The general appearance is similar to the standard range which has been reduced in price. Especially interesting is the unusually low price that has been fixed for the 3¼ cu. ft. size refrigerator.



Other manufacturers do not report any great changes in design in this year's models. Although a 3.8 cu. ft. unit is being introduced by the Century Refrigeration Co., concentration is to be on the 4½ cu. ft. size which is available at a price equal to that at which many 3 cu. ft. refrigerators are sold. The Cooper-Stewart Engineering Co., Ltd., is maintaining last year's twelve models with the "Sav-a-Step"; this container, which is normally hinged, can be hooked on to the door, or removed entirely so that foodstuffs can be taken from the cabinet, placed in the "Sav-a-Step," and removed altogether to a table. A 3 cu. ft. model may be introduced shortly.

Lower prices and five year terms have been made available by L. Sterne & Co., Ltd. The four models available have sizes of 3.3, 4.3, 6.3 and 8.1 cu. ft. The Vactric refrigerators have not been changed, with the exception of prices and the discontinuance of the model A301. Kelvinator, Ltd., is maintaining basically unchanged models. "Coldair" refrigerators have been acquired by the General Electric Co., Ltd., which is marketing a complete range from the "DMA30," a 3-cu. ft. model with a table top, to the double compartment "DMC 201" with a capacity of 15 cu. ft. "Mayflower" domestic refrigerators and a portable buffet refrigerator on wheels are sold by Catering Equipment, Ltd., while the "Chillair" models of Orme, Evans & Co., Ltd., have an oil-bath compressor and a double helix evaporator which allows the refrigerant to come into play at both ends of the coil. Other makes are the "Coldspot" (Searsint, Ltd.) and "Grunow" (Rotapex, Ltd.).



Although newcomers to the British market, the "Fairbanks Morse" refrigerators have been in existence about thirty years. They are distributed in this country by Universal Radio Distributors, Ltd., and the main feature of the equipment is the "Conservador," by means of which two-fifths of the contents can be removed without opening the main compartment. This is achieved by having a totally enclosed rack fitted to the door, so that when the door is first opened the open side of the rack, which normally faces the door, is left in position facing the user. This is hinged and can be swung out in the same way as the door, to reveal the main compartment of the refrigerator.

This method, the manufacturers claim, is designed to prevent the air in the main compartment being disturbed every time the door is opened, and in this way tends to give more economical running.

1. The 16 cu. ft. B.T.H. "PB-16"; 2. "Universal" model D.8; 3. The "Marco" C.438; 4. A new 2 cu. ft. Sparton cabinet; 5. The H.M.V. "LTP.81/37"

Commercial Refrigeration. By J. Macdonald

The author, who is on the staff of the North-Eastern Electric Supply Co., Ltd., shows that an attractive and almost untapped load is offered by electrically cooled storage. He stresses the necessity for a fully qualified servicing staff.

FROM the viewpoint of the supply undertaking commercial refrigeration presents a most desirable load as well as a means of earning profits on equipment. The modern small plant, thermostatically and automatically controlled, has a high diversity factor. It has a small demand which is essentially an off-peak load. Maximum operation occurs during the spring and summer months, thereby producing additional summer revenue, and tending to straighten the load curve.

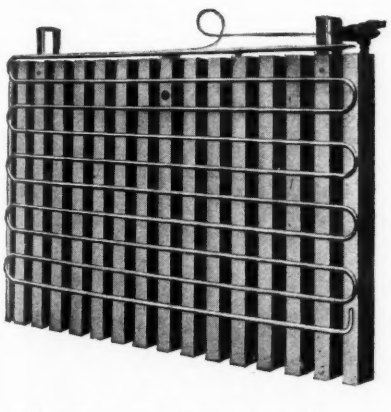
Many supply authorities have already received considerable benefits from the sales of commercial refrigerators but the proportion of machines sold to the total available prospects is very small, leaving a market of considerable extent awaiting development. Co-operation with refrigerator manufacturers is the surest way of securing this lucrative business and building up a very valuable load. Supply undertakings can gain these advantages only if they establish and direct the efforts of salesmen who have a proper knowledge of commercial refrigeration and its correct application.

The first ship to bring meat successfully from Australia, the *Strathleven*, was fitted with a mechanical refrigerator of the compressor type, and arrived in England in February, 1880. To-day the annual imports of foodstuffs into this country, carried in refrigerated ships, exceed 3,000,000 tons, of which about one-half is meat, the other half consisting of dairy produce, fruits and fish.

Refrigeration enters into the manufacture of more than 300 articles in daily use, and apart from preserving the bulk of our foodstuffs, it is applied to many purposes, including ice-making, bacon-curing, the preparation of beer, the cooling of milk, the making of ice-cream, chocolate and margarine. Refrigeration is used in oil refineries, for solidifying wet ground through which pits are to be sunk, also for the freezing out of water in air used for blast furnaces, in the manufacture of silks, and explosives.

Refrigeration is essential for producing the ice floors of skating rinks. It is utilised in all up-to-date air-conditioning equipment, for true air-conditioning is the system of simultaneous automatic control of temperature, humidity, air movement and purity. Refrigeration is even used in mortuaries, so it can rightly be claimed to serve both the living and the dead.

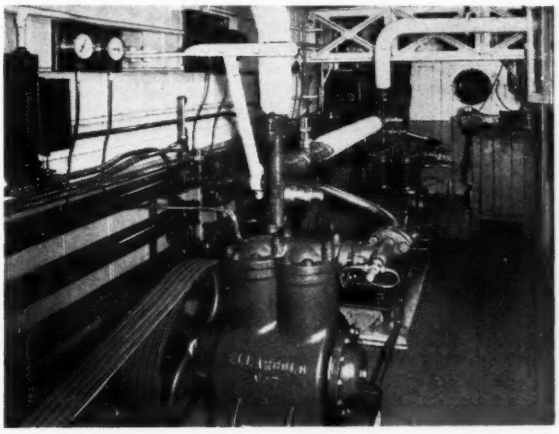
Commercial refrigeration, as distinct from industrial applications, is almost entirely confined to electric drive where electricity is available and the refrigerator manufacturers list a large range of automatically controlled motor-driven compressors, together with cooling equipment adaptable to the numerous requirements.



A Kelvinator corrugated plate room cooler fitted with a thermostatic expansion valve

A most important feature in the internal construction of the refrigerating cabinet is the insulation, which should be non-conductive, non-odorous, non-hygroscopic, not liable to silt, both vermin- and fire-proof, and inexpensive. Efficient insulation is important from an economical point of view, for once the contents of the cold store or cabinet are reduced to the requisite temperature, the entire work of the refrigerating machine will be only that which is necessary to neutralise the heat that passes through the walls, floor and ceiling from the exterior. In practice compressed cork slab is generally specified.

As regards the capacity of the machine required for the refrigeration of a cold store, it is advisable to prepare a separate estimate for each particular installation, in accordance with the amount of cooling work which is necessary, the capacity of the apparatus depending upon the lowest internal, and the highest external temperature, the area of the walls, floor and ceiling, and also to a great extent upon their construction conforming to the recognised standards of heat insulation.



[*Elec. Rev.* photo

Lightfoot-Ellarcold compressor units installed at the meat depôt of Gutteridge & Co., London

As the result of an agreement reached a few years ago, manufacturers now produce insulated equipment in standard sizes and having a specified insulation value. This arrangement has enabled the makers of refrigerating machines to market a range of motor-driven compressor-condenser units of standard capacities for commercial requirements. Water cooling is generally employed above 2 h.p.

Design of Equipment

A complete commercial refrigerator comprises four main components: storage space, cooling coil or evaporator, compressor-condensing unit, and temperature control The leakage of refrigerant gas from the compressor crankcase or the admission of air past the flywheel extension of the crankshaft to the crankcase, is prevented by using a special kind of gland or seal which is usually of the copper bellows type. The "lapped" seating of the seal ring is held up against the shoulder of the crankshaft by the seal spring and forms a gas-tight seal. The other end of the bellows is gasketed against the end cover-plate of the compressor. The sealing action is not affected by variations in the pressure of the refrigerant gas within the crankcase.

Automatic temperature control may be accomplished by an adjustable thermostat or a combination of adjustable thermostatic expansion valve and air thermostat. A small amount of refrigerant is sealed within the copper bellows, connecting capillary tube and phial or bulb. The fluctuations in the temperature of the return or suction pipe-line to which the bulb is clamped cause an expansion or contraction of the bellows which actuates the valve to promote the correct flow of refrigerant. A similar action upon the air thermostat governs the starting and stopping of the motor. To safeguard commercial refrigerators against excessive condenser pressure control instruments in common use embody automatic electric protective devices.

The anhydrous volatile liquid known as the refrigerant used in all commercial plants is generally sulphur dioxide, methyl chloride, or "Freon." At atmospheric pressure these refrigerants evaporate at the following temperatures: 14 deg. F., −11 deg. F., and −20 deg. F. respectively. Copper pipe lines must be connected between the cooling coil and the compressor/condenser unit. Perfectly gas-tight connections are ensured by the use of unions requiring "flared" joints and the compressor oil is specially filtered and dehydrated.

The motors employed have to be of a special type designed with an unusually high starting torque, ability to start a heavy load, and to start and operate under low and fluctuating voltages yet with a low current consumption. Fractional h.p. motors are usually of the capacitor type to avoid radio interference.

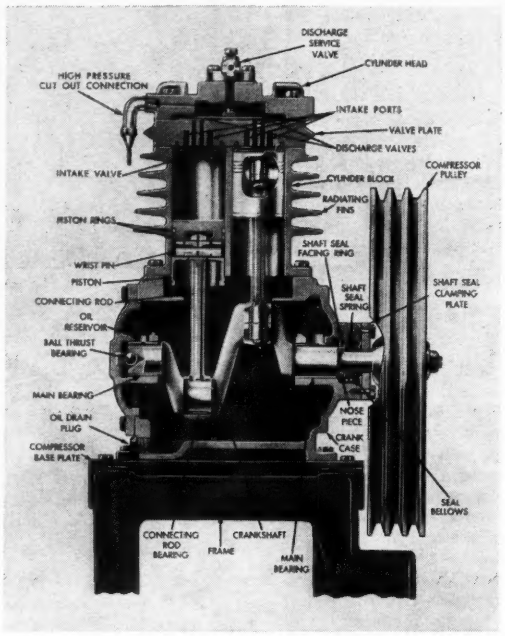
When installing refrigerating plant of any make, specified points and functions must be carefully checked. It is advisable to entrust installation work only to mechanics who have had special training. Most manufacturers offer facilities for training suitable men in this branch of work. In order to achieve the maximum of efficiency, allied with the minimum

upkeep costs, it is essential that the compressor-condenser unit should be capable of dealing with the maximum heat-load of the cold room or cabinet which should be fitted with the correct type of cooling coil. The exact type depends entirely upon the nature and the amount of produce handled, the period of storage required, and the situation of the compressor-condenser unit. These matters involve the careful study of local conditions by salesmen having an understanding of the nature of the refrigeration required, and the purpose for which it is needed. Every installation should be carefully planned to ensure a margin of refrigerating capacity in excess of actual needs.

Carefully directed propaganda has helped to create the recent expansion in the commercial refrigerator business by making merchants conscious of the earning power of refrigeration. Another big factor contributing to increased sales is the modern housewives' appreciation of the value of food hygiene, and because of this fact they look for this service from every shopkeeper from whom they buy perishable foods.

What can the small merchant, to-day's best commercial refrigerator prospect, ask and receive from a commercial installation? From 10 to 15 years' continuous service may be confidently anticipated from present-day refrigerating equipment. Compared with other applications requiring a motor of similar horse-power, commercial refrigeration has a high revenue earning value for electricity supply authorities.

The automatic refrigerator employed by the average small trader is fitted with a ¾ h.p. motor which operates in normal use for a total of about ten hours in every twenty-four, therefore the diversity factor is great. The annual electricity consumption per machine averages 3,500 kWh and carries a larger margin of profit because most of the consumption occurs during the night or during the summer, with a negligible increase in maximum demand. It is estimated that the additional energy consumption from the commercial refrigerators sold in the year 1937 must have been in the region of 60,000,000 kWh per annum.



A sectional view of a two-cylinder British Thomson-Houston compressor unit

According to statistics butchers are the largest buyers of commercial equipment. The market for ice-cream combination freezer-storage cabinets is developing rapidly, and brewery and beer cellar cooling accounts for a substantial proportion of the total sales. Mortuary cabinets are in fairly large demand, likewise combined fish and game cabinets and also display counters and cases. Factors which should increase the potential market are the number of newly wired premises connected to electricity supply; the "refrigerator-mindedness" of the modern housewife; the greater prosperity of the nation as a whole; the reduction in the price of equipment; and lower power charges.

The Selling Organisation

The connecting links between the refrigerator company and its territory sales organisation are the main dealers or the distributors. Some of the leading manufacturers have as many as 100 such sales outlets established throughout the British Isles. Generally speaking the manufacturers will sell to the electricity supply undertakings at terms which vary according to the amount of after-sales service which the various undertakings require.

The authorised distributor is generally required to act as a selling agency within a prescribed area; to establish a minimum sales force of two salesmen; to sell exclusively plant of the specified make; and to carry a small display stock. The conditions of selling agreements do not require the distributor to undertake delivery, installation or service of the equipment; the manufacturer provides such facilities direct or through a main dealer.

The terms of the main dealer agreement impose the responsibilities usually associated with a sales and services agency. A service department fully equipped with tools and spares to undertake installation and service work is required. Under these conditions no costs fall upon the manufacturers other than the supply of replacement parts which may fail under guarantee. The discount offered is usually attractive, and is based on list prices.

Supply undertakings are more favourably placed to develop sales and many more authorities could with advantage become established as main dealers or distributors and obtain the major share of the available business in their area with a resultant increase in merchandising profits. The cost of selling is not as high in relation to value as is the case with other electrical appliances. The display stock takes up less showroom space than that of any other appliance of equivalent value, and this is important in showrooms situated in areas where rental and rateable values are high. To promote sales manufacturers prepare for the distributors' use sales literature, booklets, direct-mail pieces, window-display material and co-operate in exhibiting products at shows, both national and provincial. Various trade journals are used as advertising media.

Commercial refrigeration is a contractual business—it is not just a question of selling. The complexity of factors encountered demands a higher standard of salesman than is normally required. He must be enough of an engineer to quote honest figures backed by knowledge and experience, sufficiently conscientious to sell the least equipment to fulfil the requirements, and enough of a salesman to leave behind a completely satisfied customer. Special sales training is available at schools conducted by the manufacturers at their headquarters or works or at some convenient place within the agent's territory. The leading manufacturers are prepared to help in finding and selecting men. Sales training is given to men on their own ground which helps them and saves the distributor the inconvenience and expense of sending them to London or other centres. In addition to sales training, the services of experts are available to advise on all sales and technical problems.

Competition from ice sales is now negligible, and most sales resistance encountered is due to the prospects' inability to decide upon the particular make of plant to install or upon the method of purchase. Prospective buyers show the greatest interest in the quality of the plant offered, the stability and efficiency of the sales and service agency and the price and terms of purchase. Generally speaking, equipment on the market to-day is covered by the makers' 12 months' guarantee against faulty material and workmanship and free service for 12 months from the date of installation. Manufacturers offer hire-purchase terms over periods of up to three years.

Satisfied users are by far the best new business promoters, therefore in considering which refrigerator is to be marketed, service is all-important, because excessive service calls and a responsibility for dissembly and reassembly of plant can easily absorb the profits and bring the business into disrepute. The success of any make of refrigerator largely depends upon the correctness of its installation. Installation and service mechanics must first and foremost thoroughly understand the theory of refrigeration; knowing how to avoid trouble is just as important as learning how to overcome it.

The service department should be properly equipped with tools, a supply of refrigerant and refrigerator oil, as well as such spare parts as are commonly required. The possession of this equipment enables prompt service to be given. It is essential that service mechanics shall be provided with accurate pressure and compound gauges and thermometers. Readings made with inaccurate instruments will result in inaccurate interpretation of the conditions and an incorrect adjustment with the resultant improper operation of the machine.

"Electric Refrigeration News"

This is the title of an eight-page newspaper issued by E.D.A. in connection with its Refrigeration Campaign, calling upon dealers to put 500,000 more electric refrigerators into the homes of Britain. E.D.A. is supplying at 6d. each food safety thermometers, showing the critical food safety temperature, 50 deg. F., and designed as a demonstration gift to prospective customers. The E.D.A. general domestic effort is referred to in our "Business Notes."

Boiler Tests at Bristol

An efficiency of 86 per cent. after allowing for consumption by auxiliaries

A FOURTH section is being added to the boiler house of the Bristol Corporation's generating station at Portishead. This, like the third section, will contain four Mitchell tri-drum bent-tube boilers each with a heating surface of 15,100 sq. ft., plus 2,386 sq. ft. for the water walls.

The unit incorporates a "Melesco" superheater (8,200 sq. ft.) with desuperheater, Senior "Heenan" twin-tube economisers (11,907 sq. ft.), two Howden-Ljungström air preheaters (8,250 sq. ft. each) and induced- and forced-draught equipment, and Illinois twin "V" type stokers (560 sq. ft. grate area).

An efficiency for one of the existing units of 86 per cent., after allowing for the consumption by the auxiliaries, has been achieved in the conditions stated later.

A characteristic feature of the Mitchell boiler is the wide spacing of the staggered tubes in the front bank which, while exposing a large extent of tube area to radiant heat, avoids restriction of gas passage due to slagging. Another special point is the arrangement of the steam drum to ensure that dry steam passes to the superheater under all conditions of operation. In the design of the combustion chamber, refractory material and water-cooled surface is proportioned to the quality and quantity of the fuel to be burned, which is here of a semi-bituminous nature.

The Illinois stokers are of the chain-grate type in which the grate links of heat-resisting cast iron are all drilled to jig and the driving sprockets have machined teeth. Air for combustion is delivered beneath the lower run of the grate through which it passes, extracting heat from it before entering the ten compartments. The system is designed to secure regular progressive combustion, thus making dumping bars unnecessary. This, we are informed, is an exclusive feature of Illinois stokers and has the advantage of obviating ash and clinker troubles.

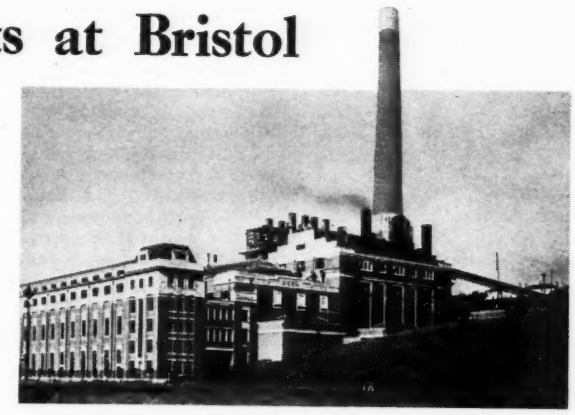
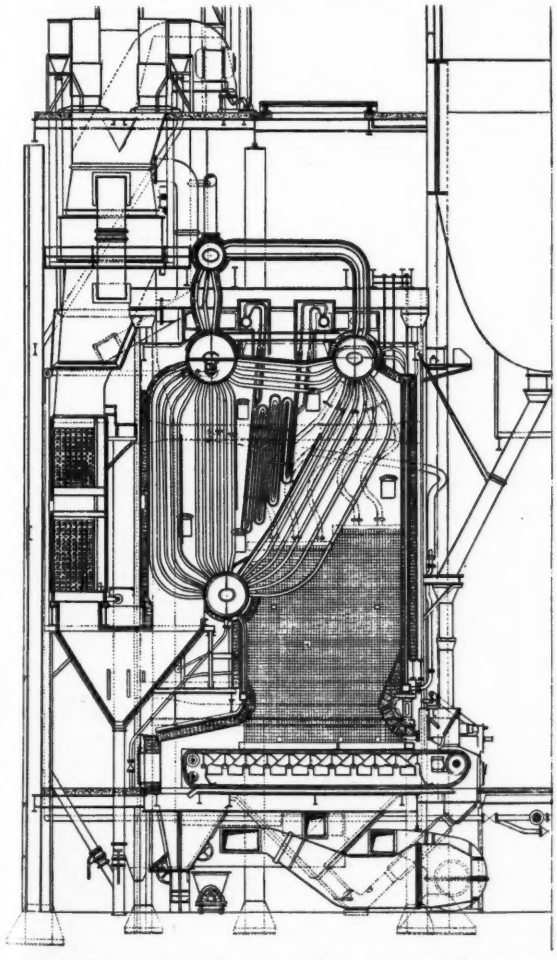


TABLE I.

Flue Gases	Economic %	M.C.R. %	Draughts	Economic %	M.C.R. %	Air	Economic %	M.C.R. %
Temperatures (deg. F.) leaving:			Suction (in.) in:			Pressure (in.):		
Boiler	691	748	Combustion chamber ...	0.09	0.09	At air-heater exit	1.18	1.60
Economiser ...	388	403	At boiler exit...	0.30	0.50	In secondary air duct	7.00	7.00
Air preheaters ...	211	225	At economiser exit	4.50	7.00	Temp. (deg. F.) entering pre-heater ...	131	133
Analysis at air heater exits:			At air-heater exit	5.43	8.10	On boiler house floor	85	85
CO_2	10.79	11.79				Leaving air-preheaters ...	249	249
O_2	—	7.22				Atmosphere ...	45	45
N_2	—	80.74						

Heat Balance	Economic %	M.C.R. %
Overall thermal efficiency	87.82	86.58
Losses:		
Dry flue gas and excess air	4.96	5.23
Combustion of hydrogen...	3.62	3.41
Moisture in fuel	0.61	0.60
Combustible in ash	—	—
Riddlings and grits	0.55	0.93
Radiation and unaccounted for... ...	2.44	3.25
	100.00	100.00
kWh used on auxiliaries	1,840	2,143
Efficiency (allowing for consumption by auxiliaries)	86.06	84.94



Arrangement of boilers and auxiliaries in the third section

Official trials on one of the boilers in the third section have recently been carried out in accordance with contract conditions that called for a test after the unit had been in service for ten months and on load continuously for not less than six weeks after having been started up in a commercially clean state. Two tests were made, both of 8 hr. 1 min. duration, one at economic rating and the other at maximum continuous rating. Throughout the first, we are informed, there was no modification in the operating conditions, which would seem to indicate that the performance can be reproduced under everyday commercial conditions.

TABLE II.

	At Economic Rating				At Maximum Continuous Rating			
	Weight lb.		% of fuel fired	% of combustible	Weight lb.		% of fuel fired	% of combustible
	Total	Average per hr.			Total	Average per hr.		
Ashes ...	4,659	581	4.31	4.60	6,168	769	4.65	5.95
Riddlings ...	1,259	157	1.17	16.90	1,272	159	0.96	18.00
Grits ...	364	45	0.34	28.10	1,522	190	1.15	33.80

The fuel used was Newport Abercarn washed rubbly small with a proximate analysis on the economic load test of: moisture, 7.1 per cent.; volatile, 24.1; ash, 7.2; fixed carbon, 61.6. Calorific value as weighed was 13,260 B.th.u. per lb. and ultimate hydrogen 4.699 per cent. The total coal fired was 108,038 lb., which works out at 24.11 lb. per hr. per sq. ft. of grate area; the fire was 6 in. thick and the grate speed 5 in. per min.

In the m.c.r. test proximate analysis gave: moisture, 6.9 per cent.; volatile, 23.9; ash, 6.7; fixed carbon, 62.5. Calorific value as weighed was 13,330 B.th.u. per lb. and ultimate hydrogen 4.411 per cent. During this test 132,773 lb. of coal was fired or 29.64 lb. per hr. per sq. ft. of grate area. The same thickness of bed was carried, but the grate speed was 6 in. per min.

Loss of unburned carbon, as contained in the ash riddlings and grits, is shown in Table II to be exceptionally low, which is attributed to the design of the grate surface. No riddlings were returned to the furnace during the test and the weight given represents the total quantity produced.

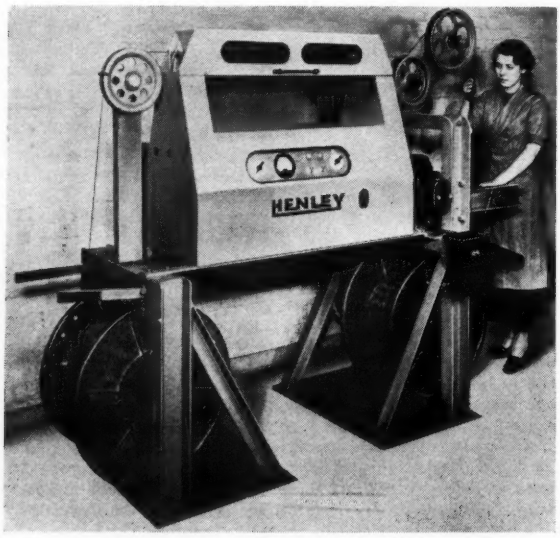
Evaporation per hr. at the economic rating, corrected for feed temperatures of 292 deg. F. on entering economiser and 388 deg. on entering boiler, worked out at 133,340 lb. or 9,895 lb. per lb. of fuel; the gauge pressure at superheater outlet was 330 lb. per sq. in., the final temperature 829 deg. F. and the total heat from feed 1,177 B.th.u. With corresponding temperatures for m.c.r. conditions of 286 deg. and 395 deg. the evaporation per hr. was 161,130 lb. or 9.729 lb. per lb. of fuel; in this case the final steam conditions were 300 lb. per sq. in. (gauge) and 836 deg. F., the total heat from feed being 1,186 B.th.u. Other technical data relating to the conditions or surface leakage over the cable.

In addition to providing the boiler plant for the third section, the Mitchell Engineering Co., Ltd., was responsible for the building and for the coal and ash-handling plant. The work was carried out to the instructions of Mr. A. J. Newman, chief engineer and manager, Bristol Corporation Electricity Department. For the fourth instalment, now in course of erection, the contract covers all work connected with the boiler house, including foundations, steel and other constructional work.

Spark Testing of Cables

An alternative to immersion

THE practice of immersing rubber core and cables in water for carrying out insulation resistance and pressure tests at the cable manufacturers' works, dates back to the early days of the industry when most cables were made for submarine telegraph and operated in water continuously. There are, however, objections to the water-immersion test. Perfect drying afterwards is difficult, particularly with taped core, which has to receive coverings of other material, as any moisture left may be trapped in the finished cable. Also, the water may penetrate to the conductor at defective places with a consequent risk of setting up corrosive action; if the cable breaks down on pressure test, the arc may destroy all evidence of the cause of the fault and may burn adjacent turns on the drum. As it is usually undesirable to immerse finished braided cable in water the tests have to be taken in the core stage and defects which develop in subsequent manufacturing operations may be overlooked.



A Henley spark tester mounted on pay-out and take-up stands, as actually installed for routine testing

In recent years attention has been given to a dry-test method known as "spark testing." This consists in passing the cable through a metallic electrode which makes contact with the surface. The electrode is maintained at a high voltage with respect to the cable conductor, and when a fault in the cable insulant enters the electrode, a spark passes. Visual detection of the spark is unsatisfactory for routine testing and some form of automatic detector has to be used.

An equipment has been developed by W. T. Henley's Telegraph Works Co., Ltd., for the factory testing of plain-rubber core, taped core and tape-braided and compounded cables. The standard unit is suitable for working voltages up to 660 with conductor sizes up to 0.0225 sq. in.

As each portion of the cable is in the electrode for only a fraction of a second, the detector must be very fast acting. In order to safeguard the machine operator the electrode voltage is kept as low as possible and a fault-current limiting device is employed; consequently, the relay has to respond to very small changes of current at high voltages, yet it must be unaffected by different sizes of cable and variations in test voltage.

In the Henley spark tester the high-voltage supply to the electrode is at 50 cycles, but the capacity and inductance of the circuit are such that when a spark passes at the cable fault high-frequency currents are set up. Coupled to this circuit is a hot-cathode grid-controlled gas-filled valve which acts as a trigger relay to h.f. currents, its anode circuit actuating a master relay. As the detector will only function when h.f. currents are present (*i.e.*, when a spark occurs at a fault) it is unaffected by any variations in 50-cycle charging current or surface leakage over the cable.

The advantages of a gas-filled valve detector are high sensitivity and ability to operate in a few micro-seconds, passing a relatively large current to the master relay, which stops the winding motor and rings an alarm bell. When triggered by a fault, the grid loses control and current continues to flow in the anode circuit, so that the alarm bell continues to ring and the motor cannot be started again until the switch in the valve anode circuit has been reset.

The high voltage need not completely puncture a faulty place, for when particles of foreign matter or definite irregularities in the cable insulant come close to, or under, the high-voltage electrode, the small spark discharge at the defect sets up high-frequency oscillations of sufficient magnitude to trigger the valve. Certain types of faults can also be detected which are unlikely to show in water-immersion tests.

Method of Employment

All the electrical apparatus of the spark tester is contained in a cabinet which may be mounted over the winding stands. This brings the electrode to eye level and also raises the control panel to a convenient working height. The valve is visible through a window. The high-voltage electrode is mounted over the cabinet but in a separate compartment lined with sheet metal and provided with wire gauze windows, which prevent ozone collecting. The electrode system consists of strips of hardened steel chain mail stretched by springs on metal frames carried on insulators, each frame being in two halves hinged at the bottom. After passing between the two strips of chain mail forming the first half of the electrode the cable passes through the second half which is set at an angle to the first. The mechanical pressure exerted by the electrode on the cable is light and cotton fibres or other matter that may be rubbed off do not clog the chains but fall to the bottom of the compartment.

The high-voltage transformer, valve and relay and control panel are mounted on a baseboard which can be withdrawn from the main cabinet.

A direct-reading electrostatic voltmeter shows the potential of the electrode, which can be varied between 4 and 11.5 kV. A double-pole switch controls the transformer and a red pilot lamp shows when this is on, a similar switch with a blue pilot lamp controls the detector, and a small neon pilot lamp shows that the a.c. supply is on the apparatus.

The sensitivity of the detector can be varied over a limited range by means of a potentiometer on the d.c. grid bias of the valve, and the operator can easily check the working of the detector, relay and alarm. Before leaving the factory every spark tester is adjusted to the correct degree of sensitivity, and both the voltage of the electrode and the sensitivity of the detector can be accurately controlled.

In order to safeguard the operator against shock the metal linings of the cabinet and electrode compartment are earthed, earthed guides are fitted at each end of the electrode compartment, interlock switches are arranged on the electrode compartment and cabinet doors, an automatic earth drop switch is fitted over the electrode, and a condenser limits the 50-cycle current to 8 mA at 10 kV.

The only external wiring is a twin cable to the mains supply, another to the no-volt of the motor starter, and an earth wire. Approximate dimensions are: Base 45 by 19 in.; height to centre of electrode, 32 in. The apparatus operates on any of the usual single-phase mains voltages up to 250 V. The power required is less than 100 W, and the cable to be tested can be run through at high winding speeds. Drum stands and winding motor are not incorporated in the standard unit.

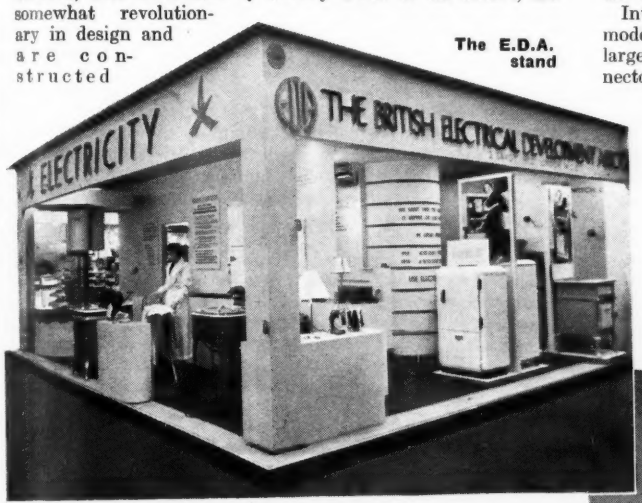
The Ideal Home Exhibition

Increasing interest shown in electrical exhibits

FOR many years to come it is likely that the domestic field will offer the greatest opportunities for expansion to the electrical industry. For this reason, in spite of last year's decision on the part of the leading electrical manufacturers not to organise a separate electrical section at the Ideal Home Exhibition, it is not surprising that at this year's function, which opened at Olympia on Tuesday, items of electrical interest are, if anything, greater in number and are without doubt attracting more attention.

"Full houses" have been general this week at the electric cooking demonstrations given by the British Electrical Development Association, which has its usual representative display of equipment. E.D.A.'s "theme-song" this year is "Plug in—switch on," and this is used all over the stand to draw attention to particular items. The advantages of electricity for solving hot water problems are indicated by an illuminated cascade of water from three heaters, while one section of the exhibit reminds housewives, or more likely their husbands, that "washing is hard work until you have an electric wash boiler, washer, wringer, drying cupboard, iron and ironer." A large-scale model of a reflector fire measuring about 6 ft. by 5 ft. is a feature of the heating section.

The latest streamline cookers as used in the royal kitchens at Sandringham hold pride of place on the Belling stand, where visitors may also see the popular "Baby Belling" models, as well as examples of fires, convectors and air circulators. With their cylindrical ovens the "White Knight" cookers, first introduced by Rubery Owen at the B.I.F., are somewhat revolutionary in design and are constructed of sheet steel, like the already well-known "Chef" cookers shown elsewhere by Orme Evans. Table cookers on view include the popular Stokes model and the recently introduced "Dixram" apparatus, which can also be used for some seven other purposes besides. The "Lite-on" combined griller and hot-plate is demonstrated by the Dominion Electrical Co.

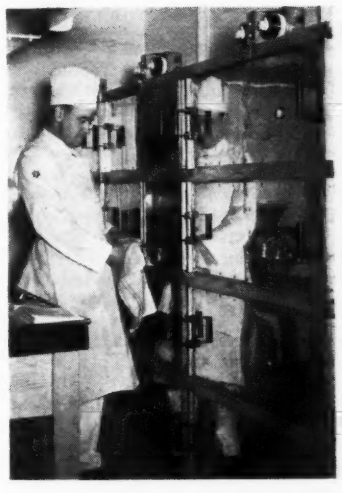


The E.D.A. stand

The first "No. 511" electric kettle to be made in copper was shown to us on the Corfield-Sigg stand, where other new additions include a toaster which automatically turns the bread, Rototherm thermometers for refrigerators and cookers, and a redesigned "Kompacte" set. The last-mentioned item comprises a 600-W portable hot-plate, kettle, percolator and saucepan, and seems admirably suitable for use in flats, &c.

Frigidaire are creating a good deal of interest with their new 22-guinea family model refrigerator, which like other refrigerators displayed is referred to elsewhere in this issue. A small reduction in the price of their smallest model has been announced by Lightfoot. Refrigerators built into sinks, cupboards, &c., as shown by Orme Evans and Ismay, not only save space but eliminate much unnecessary walking.

The new "Chameleon" colour-changing fireplace is the *pièce de résistance* among a range of "Magicoal" and "Haloberry" fires made by Berry's Electric, who have also some of their latest lighting fittings to show. A wide selection of portable and inset fires, convectors and imitation coal models, is provided by Bratt Colbran, who specialises in complete surrounds. The "Ottest" convector, shown for the first time by the Interoven Stove Co., is of modern design having an illuminated ornamental grid. A patented system of assembly enables the casing of the Thermovent convectors (E. K. Cole) to be kept compact, yet remain at room temperature.



[Elec. Rev. photo.

G.E.C. electric hot cupboards in the serving room of a warship in the "How the Navy is Fed" Section

Several new or improved cleaners make their first bow to the public. The new Tellus canister-type machine is almost unbelievably quiet in operation due to its motor being sprung on rubber. It is fitted with twin filters and a radio interference suppressor. All the tools supplied for the well-known "Master" cleaner can be attached to a new low-priced cylindrical model marketed by New Welbeck. Although slightly larger and more powerful than the "Model 16" which it replaces, the new "Model 24" Electrolux cleaner is considerably lower in price, while an additional refinement on the "Electrix" machines (Ismay Distributors) is the swivel attachment of the connector.

Intermediate between the "Silent Q" and the "Popular" model, the new "W.100" Vactric cleaner has an exceptionally large dust capacity, a rubber-mounted motor, a swivel connector, and a sleigh runner ensuring easy movement over any surface. The "Electronaire" multi-purpose combined heater and cleaner can now be supplied in a handsome wooden cabinet which may be used as a hall table, &c., shelves being provided for telephone directories, &c. When coupled to a special attachment the machine may be used as a washer of the aerating type.

An automatic coil winder, an adjustable brush heater which minimises carpet wear, and four wheels to ensure stability are some of the features of an American cleaner shown for the first time by the Diehl Mfg. Co. A roller has now been added to the lawn mower attachment of the Rollnick & Gordon "Columbus" four-in-one machine which can be used for cleaning, scrubbing and suction floor polishing. A complete range of "Goblin" appliances is displayed by the B.V.C. Co., while Hoover draw special attention to their new "Cleaning Ensemble." The Cento-Vac central cleaning system has been designed especially for houses and flats. "Poliflor" polishers appear on the stand of Practical and Industrial Distributors.

[Elec. Rev. photos.

Manufacturers of home laundry equipment are at Olympia in full force. A combined washer and spin dryer is the latest Lightfoot development. In their new *de luxe* "Thor" washer Hurley have a truly cornerless machine, which has its control switch at the top, a self-adjusting wringer, a flex container inside the base, and feet adjustable for uneven floors. A new "Crossley" washing machine and ironer for the first time by A. J. Balcombe. Efficient washing whatever the depth of water is claimed as a result of using a floating agitator on the "Goblin" machines. Beatty Bros. have intro-

duced stainless steel tubs, and Barker & Turner are supplying the "Bar-Spot" washer fitted with an electric water heater. A full range of equipment is shown by Apex-Vactric and also Servis Electric Washers. The first model of a new drying cabinet called the "Idri" is to be seen on the Ismay stand.

The new Hurley "Foldaway" ironer has its elements divided into two halves permitting heating at one end only if desired. It is thermostatically controlled and is supplied with a useful extension board for folding purposes. Heat selection and thermostatic control are features of an exceptionally low-priced Morphy-Richards "Auto-Control" streamlined iron.

Electric water heaters covering all domestic purposes are shown by Thermics and a novelty on the Hotpoint stand is a kitchen disposal unit which pounds all refuse into pieces small enough to pass safely down the sink waste pipe. Both Hotpoint and Lightfoot are receiving many inquiries for their washing-up machines. A 7ft. high working model of a "Tecal" automatic tea making set is attracting a considerable amount of attention on the L. G. Hawkins stand. A similar tea-making outfit, the "Teesmade," is to be found on one of the B.V.C.'s stands, together with electric clocks, other exhibitors of which are Bulle, British Electrical Installations, Orel-Micro (makers of the "Clipshave" electric razor), and Graham Farish (who also show a low-priced electric fountain).

Attractive new models of the "Litlux" bedlights in silk and vellum are a feature of the Dernier & Hamlyn stand. Britannia Lamps are giving a lampshade away to purchasers of four household lamps. Henley "Solon" soldering irons are demonstrated.

Apparatus in its appropriate setting is to be seen in an all-electric house built by F. & C. Costin, while various attractive lighting effects have been produced in the City of Glass, where fittings made by Restlight, James A. Jobling & Co., and Troughton & Young have been employed. Incidentally, all the interior lighting installation work in the exhibition, both stand and decorative, was carried out by A. O. Gibbons.

Television should receive a useful fillip as a result of the special feature entitled "Behind the Scenes of Television." A full-sized television studio in operation enables visitors to compare an actual performance with the reproduction on one of twenty-six receivers of six different makes (Baird, Cossor, G.E.C., H.M.V., Murphy & Marconiphone). Research, the teleprinter service, house exchange telephones and the travelling post office, are features of the Post Office exhibit.

Science Aids Industry

The work of the N.P.L. in 1937

THE material assistance that the National Physical Laboratory has been able to offer industries of all sorts, which it is hoped to render in an even more effective manner in future, is stressed in the annual report for 1937 (Stationery Office, 2s. 6d. net). In addition, the Laboratory conducts its own very varied researches, the results of some of which are contained in over 100 papers that were published last year. The Physics Department (superintendent: Dr. G. W. C. Kaye) records continued investigations of materials by X-ray diffraction methods, including electro-deposited chromium, fatigue failure of metals, structures of resinous insulators and micas; and X-ray studies of human teeth made.

It has now been established that the use of the same unit of quantity (the röntgen) is practicable both for X- and gamma-radiations if a more generalised definition is adopted. About 25 gr. of radium was tested during the year, which is 25 per cent. more than the previous record. A new vacuum electrometer valve amplifier has assisted materially in this work and a compact neon-tube detector has been designed for searching for lost radium.

During the year the "phon" was adopted as the international unit of loudness and the use of the "decibel" was restricted to energy ratios or related quantities. For the Ministry of Transport, a portable objective noise meter has been designed to give the same performance as the "standard" N.P.L. instrument. It employs a piezo-electric microphone, battery operated amplifier and a diode rectifier, followed by a d.c. amplifying valve functioning as an indicating meter. Its range is from 80 to 115 phons and means of calibrating it are incorporated. Also in this connection the Ministry of Transport has been recommended to limit the noise made by electric and other motor vehicle horns to 100 phons at 20 ft.

It is now possible to measure temperatures between red heat and 2,000 deg. F. with an accuracy of one-twentieth of a degree. Further progress in precision furnace work will be facilitated by the installation of an a.c.-d.c. dynamo, battery excited, and driven by a d.c. motor, the speed being controlled by a synchronous motor. Thus the output can be made constant in voltage to nearly one part in 1,000 for an hour or more, which, in conjunction with a thermostatic relay, enables the temperature in a platinum-wound furnace to be controlled to at least one part in 10,000. The resistor element of the furnace forms one arm of a bridge, so that out-of-balance actuates a relay system, incorporating two photo-electric cells and a tilting-tube relay that actuates a motor for rotating a rheostat in the field of the dynamo, so adjusting the input.

Precise Measurement

The Electricity Department (superintendent: Dr. E. H. Rayner) has had to adapt itself to, and provide increased facilities for, the calibration of sub-standard apparatus required for testing electricity meters under the 1936 Meters Act.

New standards of inductance, time and frequency, have been constructed for extremely precise measurements. The new variable mutual inductance has coils which have been prepared in a special manner (described in the report) and a scale that is ten times as open as that of the old instrument; settings may be made to one part in a million, electrostatic screens ensure that the coil capacities are small and constant at the higher frequencies, and a compensating device reduces phase change to barely measurable dimensions.

The improved electrically maintained quartz ring oscillator has been made sufficiently robust for use in industrial laboratories. Instead of being freely suspended by fine wires, support is provided at three fixed points at the nodes. A mode of vibration giving six nodes is employed. Such standards in an evacuated enclosure and under temperature control, are accurate to a fraction of a second per year, being a little better than the original one part in a hundred millions. One such standard ring has been installed at the N.P.L., another has been constructed for use at the Royal Observatory at Greenwich as a standard clock, and two others are to be made for the Australian Government for use in connection with radio communication.

The new method devised for determining the properties of insulating materials has been used extensively and its range of usefulness considerably extended; liquid as well as solid materials can now be measured and the same apparatus has been employed for ascertaining the characteristic constants of the newer types of high-frequency cables, and for investigating variation of inter-electrode capacitance of thermionic valves at television frequencies. There has also been a considerable demand for the calibration of ammeters at very high frequencies.

High-voltage work has included studies of the performance under impulse conditions of two sizes of cable for working at 10 and 20 kV and this investigation is being extended to two larger sizes of cable.

Apparatus has been installed for testing nickel-chromium resistance alloys at high temperature by the Bash & Harsch (American) method. This consists in heating specimen wire in air by a.c., instead of in a furnace as required by B.S.S. 115. Both methods place the wires in the same order of quality.

Increased battery capacity now makes it possible to test fuses and circuit breakers under short-circuit conditions with up to 16,500 A at 250 V and 10,000 A at 500 V.

The "New Candle"

The Photometry Division (principal officer: Dr. J. W. T. Walsh) is preparing for the adoption on January 1st, 1940, of a new unit of luminous intensity. It is defined as one-sixtieth part of the luminous intensity of one centimetre of a black body (total radiator) at the temperature of solidification of platinum (2,046 deg. K). The designation is "new candle," for differentiation from the present "international candle" and the "Hefnerkerze."

The relative advantages of light of different colours for enabling objects to be "picked up" at night on the roads has been investigated by means of a cinematograph film. On a suitable street at night, objects of various sizes and shapes, *e.g.*, models of a human figure or of a dog, and discs of various reflecting properties, are placed one at a time on any part of the carriageway or footpath, their contrast with the background depending on the lighting conditions at the particular point selected. Photographs of the street are taken with and without the objects in position, and a film is then made from this series of still negatives.

By suitable means it is possible to project the picture with light from various types of lamps, of different colours, and it can be arranged that the brightnesses of the various parts of the projected picture are closely the same as those in the original scene. The effect of the actual street lamps is imitated by holes in the screen, each illuminated from behind by a lamp of the type under study. The times taken by observers to detect the various objects are recorded, and the average of a number of observers is obtained for each set of conditions.

Water Heater Manufacture

New factory opened at Northolt

How the production of an electric water heater is undertaken in an up-to-date factory

TO meet the increasing demand for "Sadia" electric water heaters Aidas Electric Ltd., has just opened a new factory at Rowdell Road, Northolt. This is some three times the size of the old works at Park Royal and the three-acre site provides for future expansion.

The move afforded the company an opportunity of installing extra machinery and the plant has been laid out so that each operation goes in its correct sequence. The factory is practically self-contained, nearly all the components required being produced on the site.

The inner water container consists of a copper cylinder with hemispherical ends. These ends are spun from soft copper discs by six lathes individually driven by Fuller electric motors with Allen West starters. The same lathes also spin on the end rings. After annealing, the end spinnings are welded to the main body of the cylinder, using soft copper welding rod. The complete containers then go to a test rack where they are subjected to a 120 lb. per sq. in. pressure test. Successive baths of acid and water then render them ready for tinning, which is carried out in a thermostatically controlled electric vat (of the company's own design) six feet deep and containing pure molten tin. A further 20 min. test at 120 lb. per sq. in. pressure makes sure that there are no leaks.

[*Elec. Rev. photo.*

Spot welding the seams of the outer casing

This completes the inner containers, which, in the course of manufacture, have now reached the end of one of the production lines where they meet the outer casings. These outer casings are made from silver steel sheet.

The main bodies are formed from rectangular sheets cut by a guillotine and then rolled into cylinders, the seams being spot welded by a 28-kVA Siemens-Schuckert welder. The ends are swaged and the complete cylinder is placed on a jig to ensure that the wall fixing brackets are fitted in the correct position. These brackets are riveted to the cylinder by a Hunton riveting machine. The same machine is used to insert hank bushes for screwing on the top pressing.

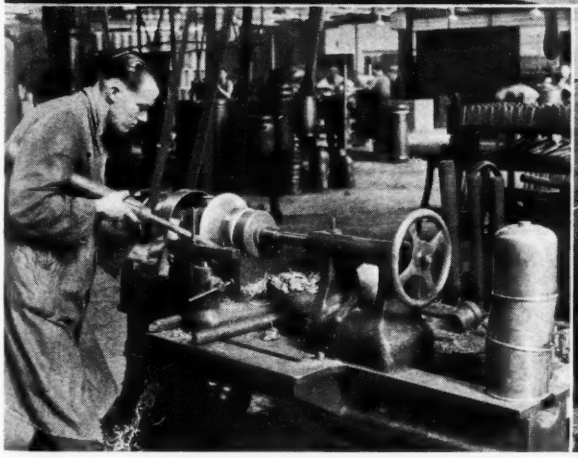
An asbestos composition spacing ring is inserted at the bottom between the outer and inner containers and the space between them is filled with cork. This filling is done by means of an automatic machine of the company's own design. The tops having been screwed on, a high-cycle grinder finishes off the case-work preparatory to paint spraying. Two treatments with undercoating and one of enamel give a very durable finish. When dry, the cylinders are taken to the assembly bay for the insertion of the electrical equipment. The elements and some of the thermostats fitted are proproduced and tested in a separate section at the other side of the factory.

Finally completed, the heaters are stored in racks in a capacious despatch room, into which vans can enter for loading. To prevent any possibility of being held up for lack of materials, the factory has been provided with exceptionally large storage accommodation.

It speaks well for the modern methods of production employed and for the organisation of the company that less than a week after the removal to the new premises—the move took only four days—the output showed a considerable increase over that obtained at Park Royal.

The electrical installation was carried out by the City Electrical Co., Benjamin reflectors being used for the artificial lighting.

The accompanying illustrations include a view of the new works, which can be extended to about twice its present size as and when the need arises. Some of the processes described in these notes are also illustrated.



[*Elec. Rev. photos.*

Two of the stages in the production of a "Sadia" water heater at the new Aidas Electric factory (above):—Spinning the ends of the inner water container, and tinning in the electrically heated vat

Electric Locomotives

Present-day tendencies in design

THE trend of design of electric railway locomotives is surveyed in a paper by Mr. C. E. .Fairburn (London, Midland and Scottish Railway Co.), read at the Institution of Electrical Engineers in London on April 7th. The author confines his attention to main line engines designed and built since 1925 and lengthy tables containing the more important details of these locomotives are appended to his paper, which is based on information obtained from ten railways in eight countries and from twelve manufacturing concerns in five countries, supplemented with information from the technical Press.

The outstanding change in mechanical design is the widespread adoption of individual axle drive in preference to rod drive. The types most extensively used are dealt with in some detail in the first part of the paper. The second part shows that changes in electrical equipment have consisted largely of detailed improvements. Little basically new apparatus has appeared, except on two lines where the introduction of locomotives with entirely novel equipment has made possible the use of single-phase energy at industrial frequency. The author believes that this system offers the prospect of considerable development and may, in time, become a serious rival to the older systems.

The author of this I.E.E. paper finds widespread adoption of individual axle drive in place of the side-rod drive while three-phase systems are making little progress. He describes recent experiments in Hungary and Germany with light motors and novel electrical equipment

It has not been easy to find common tendencies. Apart from differing circumstances, personal preference seems also to play a part, and the same experience, when viewed from different angles, can sometimes lead to widely divergent conclusions. This is clearly exemplified by the manner in which different systems of electrification are still being chosen in different countries, *e.g.*, Austria, Germany, Switzerland, Sweden, single-phase low-frequency a.c.; Belgium, Italy, and Poland, 3,000 V d.c.; France, Holland, Japan, and much of the British Empire, 1,500 V d.c. Three-phase systems are making little progress and it is unlikely that any new installations, as distinct from possible extensions of existing systems, will be made.

Many experiments are being made, and the oil-fired turbo-electric locomotives now under construction in America will bear more resemblance to electric locomotives than to standard steam locomotives. New steam designs and the introduction of powerful high-speed Diesel locomotives are matters of considerable interest to the designer of electric locomotives, in so far as electric transmission is used.

Greater Power Demanded

For freight and low-speed passenger trains the double-bogie type of locomotive has been built almost exclusively since 1930. In the last few years the demand has been for engines of greater power, both steam and electric, and there is little doubt that in future there will be still further increases in speeds and probably also a desire to increase train weights at the same time.

If necessary two or more electric units can be coupled together and worked by a single crew. This method is in use on a number of lines and it would appear to provide a complete solution of all demands for greater power, but, in fact, under average conditions, it is expensive in first cost and in maintenance; so the present tendency whenever possible is to use larger single units. Many recent new types of locomotive are of large power, such as the German 4,150 h.p., Swiss 8,680 h.p., and Pennsylvania 9,500 h.p. examples. General experience indicates that even larger h.p. is desirable and would be economic on many lines carrying heavy traffic.

Single-phase motors can now be made more satisfactorily in smaller sizes, their weight per h.p. has been reduced, they need much less commutator maintenance and good-class gearing is obtainable. Consequently, single motor side-rod drives have been largely superseded by individual axle drives. On the Pennsylvania railroad 250,000 miles have been run without commutator grinding and one Swiss locomotive has done 400,000 miles without regrinding.

Large savings in sub-station plant and improved efficiency can be obtained by the use of single-phase energy derived from 50-cycle industrial distribution systems. This method is on trial on the Hungarian and German railways, and special light motors and novel electrical equipment has been evolved for the purpose. Satisfactory results have been obtained in both cases.

The Hungarian locomotives (16,000 V, 50 cycles) are of one type for all purposes. They have a single induction-type motor fed from a specially developed phase-convertor with two main windings, one single-phase connected to the line and the other polyphase connected to the motor. This winding can give a 3-, 4-, or 6-phase supply. The rotor has four poles, and an exciter and starting motor are coupled to the same shaft. To reduce the weight and dimensions the stator windings are oil-immersed, the oil being continuously circulated through an air-blast cooler, and the rotor has cooling tubes through which water is circulated from a second cooler. Four fixed speeds are obtainable by pole-changing on the motor in a fairly simple manner owing to the availability of the three different phase arrangements on the convertor, and intermediate speed values are obtained by the use of a variable rotor resistance. The scheme has given very satisfactory results.

In the German experiment (with 20,000 V, 50-cycle contact system) four double-bogie locomotives of similar mechanical construction, but each embodying different novel electrical equipment, have been built at an approximate cost, including 35 route-miles of overhead equipment, of 7 million marks. The electrical equipments are the products of four different firms; two of them use mercury rectifiers to supply four standard series-wound motors, and the other two use motors designed to operate on a 50-cycle supply. On the rectifier locomotives, starting and speed control are effected by varying the rectifier output voltage, which can be reduced to the necessary low value.

On one of the units this is accomplished by a tap-changing switch on the transformer high-voltage winding, and on the other unit by grid control supplemented by series-parallel and field-weakening switching in the motor circuits. The grid control is arranged to vary the voltage, partly by retarding ignition and partly by selecting, according to the controller position, one of two sets of anodes supplied from the transformer at different voltages.

An Eight-motor Arrangement

The third locomotive is equipped with two 50-cycle series-wound commutating motors per axle, eight in all, and the control-gear is similar to that standardised on 16⅔-cycle lines of the German railways. The motors, which operate at a low voltage per commutator segment, are connected permanently in pairs, and they each have fourteen brush-holders each carrying four brushes.

The fourth locomotive is fitted with a phase convertor and a 3-phase induction motor per axle, again eight machines in all. The phase convertors. have wound rotors and stators between which there is a free intermediate rotor excited wtih d.c. This provides the rotating field necessary for phase conversion.

During starting periods and when running at reduced speed the phase convertors act as motors. There are three machine arrangements; in the first convertors and motors are in cascade, thus comprising eight driving motors, in the second the convertors act alone as motors, and in the third the motors are fed from the stators of the convertors, which then develop no driving torque. Intermediate speeds are obtained by electrolytic rotor resistances, and regenerative braking takes place automatically in all the arrangements if the speed rises above synchronism.

The three locomotives first described are designed for rheostatic braking. The unit with the grid-controlled rectifier takes the motor excitation from the rectifier, the voltage of which is reduced by a switching arrangement on the transformer secondary. On the other rectifier unit the motors are self-excited, and on the unit with 50-cycle commutator motors two of the machines act as direct-current exciters for the remainder.

The German State Railways allowed the author to inspect these locomotives and he can say that they have all worked satisfactorily throughout the summer on a line which has many steep gradients.

Chilean Railway Contract

A *Reuter* message from Santiago says that the Chilean State Railways have placed railway contracts valued at £650,000 with the Ferrostal Works, Essen.

Included in the equipment ordered are three electric and seven steam locomotives, fifteen trains—some Diesel and some electric, an electric sub-station and track equipment for 75 miles of route between Santiago and the port of San Antonio which is being electrified.

It is stipulated that payment for the equipment should be made in annual instalments of £100,000 each.

The Heating of Large Buildings

Comparison considered incomplete and misleading

A paper comparing the costs of coke-boiler and electric thermal-storage heating at the Imperial College, read at the Institute of Fuel last week, was attacked on the ground that it failed to allocate costs fairly between the two systems, thus overweighting the scales against the electrical method.

THE relative economy of competitive heating agents has been discussed often and at length, but there have been few opportunities of providing a true basis of comparison in the form of actual figures obtained from full-scale experiments in the same buildings. In this respect circumstance favoured Drs. S. L. Smith and C. H. Lander who, in the paper they presented to the Institute of Fuel in London on March 31st, claimed to present performance records of the heating system, including the provision of domestic hot water, of a group of buildings of the Imperial College of Science and Technology at South Kensington.

An electrode boiler thermal-storage system of 1,750 kW at 5,250 V, three-phase, corresponding to six million B.th.u. per hour, was installed in 1930. When building modifications demanded increased capacity two magazine-type coke-fired boilers, each of 750,000 B.th.u., were installed in 1934 and so arranged that both sources of heat supply could be operated either simultaneously or independently.

The annual running cost with electricity at 0.205d. per kWh is said to favour (in this particular case) the use of coke at 32s. 6d. per ton. The authors concede that their figures refer to heating by hot water and that direct electric heating might be more economical. In the subsequent discussion, apart from speakers who referred to non-electrical aspects of the case which did not bear on the alleged comparison, Mr. S. McEwen, chairman, said that there was one outstanding feature of the results to which attention might be drawn. It had always been emphasised that one of the justifications for departing from solid fuel was the saving in labour, but this paper seemed to show that labour for the coke plant cost less than that for the electrical plant, which was most surprising.

Sir Henry Tizard (Rector, Imperial College of Science) said that this matter had been looked at from the beginning from the point of view of a consumer and, although the experiments were of value in other ways, he, as Rector of the College, was not in the least interested how, technically, the heat was obtained. The object was to get the heat that was required in the most economic way and without dirt or smoke. The Imperial College of Science was not a luxury institution and had to do these things cheaply because a great deal of the money required was provided by the taxpayer and the ratepayer, and the adoption of coke had materially reduced the fuel bill for heating. At the same time, having regard to the undoubted advantages in many respects, including flexibility, of the use of electricity it would be interesting to know whether the authors, after their experience with this plant, if they were designing the heating of an entirely new building, would adopt a storage system.

Mr. W. C. Parker's Criticism

Mr. W. C. Parker (borough electrical engineer, Fulham) said that the paper dealt with a particular isolated problem and did not prove in any way that any one particular form of heat was best. The authors would have served the interests of heating engineers far better by frankly stating that every heating problem was different, depending upon the type of building, the type of heating, and the purposes to which it was put, because it could not with justice be said that the results arrived at in the paper could be applied indiscriminately to any other heating problem. With these points in mind he emphasised that the authors' total annual costs were assumptions and not actual figures, since this particular group of buildings had never been entirely heated by coke or entirely heated by electricity. Moreover, he contended, there was a radical error in these figures. They were based on on efficiency for the coke boiler of 74.6 per cent., but this was only obtainable by working for long periods with more or less constant load on the coke boiler and utilising the storage tanks of the electrical system, yet the authors had not included in their balance sheet (against coke) the cost of this storage system. If this were done, £315 per annum would have to be added to the cost of coke.

The calorific value of the coke was given as 12,900 B.th.u., whereas the best figure which he could obtain under guarantee from the Gas Light and Coke Co. was 12,400 B.th.u. As to moisture, the paper gave a figure of 0.9 per cent., whereas his experience had been that the average moisture in coke was 5 per cent. Yet again, the extraordinarily low figure of 8.8 per cent. was given for ash content of the coke, which meant that the gas companies were buying coal with approximately 6 per cent. ash, whereas the usual figure was 12 per cent. Apart from this, the price of coke was given as 32s. 6d. per ton, whereas the figure for coke nuts for 1936 was 38s. 8d.

The average of numerous electrical installations throughout the country showed that labour cost was approximately one-quarter of that for coke or coal-fired boilers. Moreover, the paper was confined solely to the cost of heating the building and ignored the cost of electricity for other purposes. The fact was, however, that electricity undertakings based their tariffs to large consumers on load factor and the saving that would be effected on a two-part tariff would go a long way toward showing that electricity used for all purposes was cheaper than electricity used for one purpose and coke for another by the same consumer. Mr. Parker contended that he had said sufficient to show that the difference of £1,720 in favour of coke, claimed by the authors, was subject to very grave doubts and was based on peculiar circumstances without taking into consideration all the factors. Therefore, it was a figure which could not be taken seriously, and no regard appeared to be paid to the deleterious effect of the sulphuric acid which was emitted by the chimney of the coke plant while the authorities were insisting on the installation of sulphur extraction plant at power stations.

Prof. C. L. Fortescue (City and Guilds Engineering College) expressed the view that the paper revealed what might almost seem to be a retrograde step on the part of an institution which had at its disposal ample scientific facilities. That the amenities of electric heating could not be justified under the conditions prevailing at the Imperial College of Science could not be questioned, but looking at the problem generally it was impossible to dismiss from consideration the amenity value of electrical plant. He agreed with Mr. Parker that the circumstances in this particular case were special, but there were many cases in which the amenity aspect must be evaluated in a very different way. He, too, could not understand why the cost of labour was higher with electricity than coke, but it might be due to the fact that those concerned with these experiments had been unduly lavish in the amount of expert attention which was given to the electrical plant. For practical purposes the amount of attention which the electrical plant required was next to nothing at all. Another point was that the capital and depreciation charge of £1,440 was the same in both cases, but was it to be assumed that the coke boiler would not cost any more in the long run than the electrode boiler?

There were also a number of other factors which needed modification before one could arrive at an actual comparison, such as, for instance, the use of the thermal-storage equipment which was already existing when the coke plant was put in. In crowded cities the higher cost of electricity, as such, would be economical when consideration was given to the difficulty of handling solid fuels and the damage to surrounding buildings caused by the emission of sulphur.

Fundamental Difference Ignored

Mr. A. H. Barker said that this paper would go out to all the world indicating that under the authority of two eminent professors of the Imperial College of Science a storage system had been tested against a coke-fired system in those buildings and had been found to be about three times as expensive. The experiment, however, did not compare the two systems nor prove anything of the kind, and it was to be regretted that the paper should have been published because it was not fair to the coke system and still less to the electrical storage system. It was well known that he held no brief for the electrical storage system, which he regarded as too expensive and only justifiable in cases where a fuel-fired system could not be adopted, but it was incumbent on any body professing to test the system to make sure that the tests were fair to a system labouring under the immense and obvious disadvantage of a high-priced fuel. Both kinds of boiler had been connected to the same storage and both had been used in conjunction with a hot-water supply system, thus completely neutralising the fundamental difference between the two, which was that with an electrical storage system heat was developed irrespective of the time when it was to be used, whereas with a solid fuel system the heat was used immediately it was developed.

After pointing out that the electrical system did not create products of combustion, Mr. Barker emphasised that the fundamental question was what difference in efficiency was brought about by having the heat already generated before it was needed and in such a form that it could be instantaneously

Meetings and Discussions

In view of possible legislation on the subject the I.E.E. paper by Messrs. A. J. Gill and S. Whitehead on the causes and suppression of interference with radio reception is of immediate importance. Two papers were read at last week's meeting of the Meter and Instrument Section of the I.E.E., dealing respectively with the use of auxiliary current transformers for extending the range of a.c. metering equipment and with the residual polarisation of nickel-iron alloys. Mr. F. Gill opened a discussion on engineering economics at the last informal meeting of the I.E.E.

Radio Interference

HOW to assess interference with broadcast radio reception, caused by electrical equipment of all sorts, is explained in a paper by Messrs. A. J. Gill and S. Whitehead that was read before the Wireless Section of the INSTITUTION OF ELECTRICAL ENGINEERS in London on April 6th.

The authors first explain how to determine the level to which such interference must be reduced in order to permit satisfactory wireless service. They next describe the various means available for abating interference and, finally, indicate in considerable detail how suppression devices can be applied to a very great variety of offending electrical appliances and plant.

The paper defines interference and the method of assessing it on a field-strength basis. The general criterion of freedom is the limiting signal (programme)-to-noise ratio which, when measured by instruments specified in the paper, should be at least 40 db below the level of the transmission to be protected. The average field to be protected is considered to have a value of one mV per metre modulated at 80 per cent. For frequencies between 200 and 1,500 kc the maximum permissible interfering voltage at the terminals of a machine must be 500 μV and the interfering field strength must not exceed 100 μV per metre at a distance of ten yards. For example, if in a given case the effective height of the aerial were one metre and the mains attenuation were 37 db, a field of 1 mV per metre would be adequately protected from mains-borne radiation.

The paper describes the three methods of measuring this kind of disturbance, and compares the British, American and German instruments devised for this purpose. It then differentiates between radiated and re-radiated interference. For instance, disturbance of the first kind caused by trolley-buses may exceed 10 μV per metre up to one mile from the track, and may sometimes travel along the overhead wire all over the system. Interference from high-voltage overhead power transmission lines has not become prominent, since such lines are generally in the country remote from residences.

High-frequency electro-medical apparatus can cause very serious interference over a range of more than five miles. Cases of disturbance in this country on wavelengths between 10 and 100 m. have been assumed from a pronounced 60-cycle modulation to have been caused by medical therapy equipment in America. Electric lifts can cause annoying radiation in a number of ways, and automatic telephone and telegraph apparatus can be troublesome, particularly if overhead distribution lines are employed. The ignition systems of oil-burning furnaces can cause appreciable disturbance, while that due to motor cars is so widespread that it deserves special study.

Re-radiated interference from most kinds of domestic appliance can be of two types, namely, caused by motors and by switching devices; thus some appliances are sources of both kinds of noise. The normal path is *via* the supply mains to the vicinity of the receiving aerial, whence it is radiated from unscreened portions of the wiring and picked up by the aerial-earth circuit of the radio set.

Propagation from the offending item along the supply mains can be in the form either of a difference of potential between the two conductors themselves, or as a difference of potential between the mean potential of the conductors and earth. The former effect is generally much less than the latter.

The authors found that 352 appliances (up to 500 W), domestic and otherwise, all caused interference. This state of affairs is of considerable importance to British manufacturers, since offending appliances may be refused entry into foreign countries, while foreign interference-free goods may successfully enter the British market.

Curative Measures

It is undoubtedly possible in many cases to effect considerable relief by taking adequate measures at the receiving point. The paper explains how this can be done. There remains, however, the larger proportion of cases in which disturbance is caused by an electromagnetic wave of a frequency identical with that of the desired signal and for which no modification at the receiving end can be alleviative.

The remedy is suppression at the source, such as the prevention of sudden growth and abrupt decay of current in switching circuits. Circuits of the type employed for spark-quenching are suitable for this purpose, but the majority of cases do not lend themselves readily to this treatment, and it becomes necessary to prevent the interference leaving the source by screening or the use of filter circuits to prevent the passage of the interference to the supply mains.

A large proportion of cases can be cured by the use of condensers alone, and when connected across the terminals of the appliance they will be more efficacious where the internal impedance of the appliance to h.f. currents is high. The arrangement can be assumed to be equivalent to a potentiometer consisting of the machine impedance and condenser impedance shunted across the source of interfering voltage. The impedance of the condenser is low, so that the greater proportion of potential-drop occurs across the machine impedance and a very small proportion occurs across the condenser and supply mains.

When condenser suppressors are fitted to portable machines one condenser is usually necessary between the supply mains and one condenser between the neutral and the frame. With the use of two-pin plugs it cannot be guaranteed that the latter condenser will remain connected as originally fitted, and it has

Prevention of Interference
Auxiliary Current Transformers
Residual Polarisation

The Heating of Large Buildings (*Concluded from preceding page*)

delivered at the place where it was wanted, or shut down with a very small time lag. That was the question he had hoped would be answered by these experiments, but the authors had completely disregarded this difference. The paper was full of considerations which were completely irrelevant and were of no service at all in analysing the real efficiency either of electricity or of coke. There had been a grievous waste of a priceless opportunity of making a real investigation, and the results given in the paper were of little value except for record purposes for this particular building.

Mr. F. Selley (St. Marylebone Electricity Department) said he had had many years' experience of heating buildings with electrode boilers and he also had figures of many buildings which were heated by coke before they were heated by electrode boilers. But the comparative figures in the paper did not in any way correspond with those which he had. He inquired whether the coke plant was put in as a gift or a loan.

Mr. E. M. Ackery (E.D.A.) said that as the engineer responsible for the design and installation of the original thermal storage installation, he went to some trouble during the first two or three years of its use to find out how much heat was actually being supplied for heating purposes. It was found that in 1932-33 the heat required for the Union block of buildings was 3,540 million units, but the authors had found it necessary to use 4,794 million heat units. Why was this so, because in 1932-33 there were no complaints about the heating, and the consumption of electricity in that year was not unusually low.

In reply, Dr. Lander said that if he were, which he claimed not to be, biased, he would say that " the Lord had delivered the electricity people into their hands." As Sir Henry Tizard had said, the last word in matters of this sort was always dictated by the pocket, and the pocket of the Imperial College was the better by more than £1,000 a year because of the alteration that was made. He was not going to say whether using plant in this combined way was the best, but the use of coke partially had reduced the cost, although it might even be that if more coke were used the cost would go up. He fully agreed that each installation must be considered on its merits.

Prof. Livingston Smith dealt with one or two of the points raised in the discussion, remarking that even if a figure of 35s. per ton for coke were taken the cost would work out at £1,151 for coke and £3,371 for electrical thermal storage. He was unable to explain the difference between labour costs, as he had quoted figures which were given to him by the financial department of the College. If the electricity used for lighting and power had been included the sum of £3,000 a year would have been nearer £4,000. Each problem should be dealt with on its merits, but in this case he was concerned only with a particular problem, and if anybody cared to apply the figures to other conditions that was their affair.

therefore to be limited to a low value in order to avoid the risk of shock. This limitation has the effect of reducing the efficacy of the suppressors, but if two 0.005-μF condensers are fitted in series across 250-V a.c. supply mains and the centre point of the condensers connected to the framework, then a reasonable degree of suppression can be obtained for a large number of machines, and it has been shown by extensive tests that in the event of the user touching the framework and earth simultaneously no appreciable shock can be felt.

The authors describe in some detail how suppression devices can be applied to the variety of offending machines and appliances enumerated in their paper, which includes a long bibliography of the subject. The number of complaints dealt with by the Post Office in 1936 was 44,000, and it continues to rise. It is believed that a very large number of listeners are still unaware of the service available and are suffering in silence.

The number of equivalent full-time Post Office staff employed in Great Britain and Northern Ireland on broadcast interference work is now of the order of 250. Special courses of instruction are held, by means of lectures and special demonstrations. The equipment available to this staff comprises 110 small motor vans, each supplied with an interference locator, portable wireless receiving set, screened leads, and a miscellaneous assortment of condenser filter units and inductors for experimental demonstration purposes on the medium- and long-wave broadcast bands, but additional equipment is being provided to enable such work to be extended to the television band in the London area.

Transformers for Metering

THE employment of auxiliary current-transformers for extending the normal range of a.c. metering equipment is dealt with in the paper by Mr. G. F. Shotter (North Metropolitan Electric Power Supply Co.) that was read before the Meter and Instrument Section of the Institution of Electrical Engineers in London on April 1st.

The reasons why methods hitherto available for this purpose have not come into general use are briefly indicated. The author then states his preference for an auxiliary device which is directly applicable to existing equipment without involving any modification in the design of standard meters or current-transformers, increasing permissible errors over the wider ranges, or adding too much to the overall cost.

These restrictions resulted in the choice of a multi-range step-up transformer connected between the secondary winding of the main current-transformer and the meter. The idea is simple, but its application has involved considerable research. This method has not been feasible hitherto because of the large losses in transformers made of ordinary materials. These have been reduced by the use of Mumetal, and appropriate design provided the desired accuracy at the required output of approximately one VA. The impedance characteristic was a more difficult proposition; after a number of experimental models had been made the final form was a shell-type core with a distributed auto-type winding having an ampere-turn rating of 120. The overall core dimensions were: length, $2\frac{3}{16}$ in.; width, $1\frac{5}{8}$ in.; stack height, $\frac{5}{8}$ in.; and winding space, $\frac{1}{2}$ by $1\frac{1}{4}$ in.

All the possibilities of the method have not yet been fully investigated, but it is capable of giving accurate results over a range of 80 to 1 instead of the normal 20 to 1. Possible further improvement of the means of compensating the auxiliary may produce even better results than those indicated in this paper, particularly when used in conjunction with the lower classes of main current-transformer.

An important advantage of the method is that it saves the cost of frequently changing main current-transformers when an increase in load takes place. It is thus particularly useful in the case of sub-station "efficiency" meters, and especially so where the current-transformers are compounded in the switchgear. When the optimum value of the load has been reached, the auxiliary transformers can be used again for other equipment. Again, the method enables seasonable variations in load to be catered for, and is especially useful in the case of maximum-demand measurement. The number of sizes of current-transformers which it is necessary to stock can be reduced, and thus a saving in the work of clerical and stores staffs can be effected.

Magnetic Polarisation

THE results of an experimental investigation of phenomena connected with the residual polarisation of nickel-iron alloys, not normally encountered with more familiar magnetic materials, are recorded in the paper by Mr. T. A. Ledward (Brighton Technical College) that was read before the Meter and Instrument Section of the Institution of Electrical Engineers in London on April 1st.

By using specimens of Mumetal, Permalloy and Stalloy the author formed cathode-ray oscillograph loops by applying the secondary voltage E to the vertical deflecting plates and passing the primary current I through the horizontal deflecting coils. The shape of some of these E-I loops is somewhat similar to that of ordinary B-H loops (magnetic flux density and magnetising force) turned through an angle of 90 deg., but this is merely coincidence.

Asymmetry of E-I loops for nickel-iron cores under alternating magnetising forces is shown to be due to residual polarisation, the distribution of which throughout the cross-section of the stamping is different from the distribution of the flux due to the applied alternating magnetising force. Such polarisation may, under certain conditions, be in different directions simultaneously in the inner and outer parts of the stamping, and it can be removed by applying a relatively large alternating magnetising force and reducing it slowly to zero.

For Mumetal the curves are different when the residual flux is caused by switching off a.c. and d.c. respectively. Other curves show the marked increase in polarising flux produced by d.c. when an alternating magnetising force of suitable value is superimposed.

The apparent permeability is reduced by residual polarisation, and the latter occurs strongly, both in nickel-iron and in silicon-steel cores, under conditions in which capacitance loading of the secondary winding produces resonance with even harmonics, provided a small initial polarisation is present. Initial polarisation sufficient to allow this phenomenon to occur is usually present, even when the normal loop is almost symmetrical. The presence of even harmonics in the magnetising current, as may occur, for instance, when the source of supply is a thermionic valve, also causes polarisation. With certain values of capacitance loading of polarised specimens, sub-harmonics are produced. The asymmetry of E-I loops for specimens with residual polarisation is less apparent as the frequency is raised above 50 cycles per sec. These phenomena should be taken into account in the design and operation of electro-magnetic apparatus, but cores of the more usual commercial forms will not exhibit the phenomena to the same extent as the plain ring stampings used in most of the tests described.

Planned Economics.—At the informal meeting of the Institution of Electrical Engineers in London on March 28th Mr. F. Gill carried his crusade a step farther by opening a discussion on "Engineering Economics in Planning," a subject with which he has been associated for many years, especially at meetings of the younger engineers. Mr. Gill said that engineering, which was the application of science to meet material ends, implied the use of economics in order to obtain the most efficient overall result.

He asked that the students of engineering colleges should be taught to study costs, not as applied to factory management, but to the design and planning of operations. This demanded a knowledge of the properties of materials, of how to evaluate costs and the recognition that there was usually more than one way to achieve the desired result. Various factors determined the choice. The more expensive first cost might often be much cheaper in maintenance. There must therefore be at hand records of the variations in the costs of materials, labour, capital, etc., together with the causes of these variations so that future variations might be estimated. Without all these data schemes involving heavy expenditure could not be presented.

I.E.E. Functions

SPEAKING to the toast of "The Institution of Electrical Engineers" at the Swansea Sub-Centre re-union, Principal Thompson, of the Swansea Technical College, put in a plea for more co-operation between the Swansea Centre and the students of the colleges with a view to a "real live students' party in Swansea," for more commercial teaching for electrical engineers, and for greater support for the Engineering Public Relations Committee. Mr. J. E. Dawtrey opened an informal discussion on "Electrical Accidents and their Causes," and Mr. C. T. Allen, of the South Wales Power Co., stated that the solution of the problem of accidents in households was the leakage trip switch. The domestic flat iron and washing machine when used in rooms with stone floors were a danger to the housewife.

At the recent annual dinner of the Tees-side Sub-Section of the Institution at Middlesbrough, Dr. A. Fleck (Imperial Chemical Industries, Ltd.), proposing the toast of the I.E.E., referred to the strides made with steam-produced electricity. With regard to supply, he said that although there was a satisfactory use of electricity in urban areas the same could not be said of rural areas. At present only 11 per cent. of the farms in this country used electricity, and here was a field where electrical engineers should devote their energy to get power distributed. Sir George Lee, President of the Institution, said they all wanted to see the re-birth of the agricultural industry in this country, and in this connection electrical engineers were doing great work. Mr. J. H. Haws presided.

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Correspondence

Contributions from readers are welcomed. The writer should give his name and address, not necessarily for publication

Air Conditioning

With regard to the article on "Air Conditioning" by Mr. E. M. Ackery in your issue of April 1st, some of the points raised are of extreme interest, but it occurs to me that the tale told is somewhat glowing from the standpoint of economy when the reverse cycle of refrigeration is being considered. Surely Mr. Ackery has rather slipped up in suggesting that the law of conservation of energy does not apply in this case. In the circumstances, should one be constantly in a position to produce 8,000 B.th.u. for the expenditure of the equivalent of 2,900 B.th.u. practically all our power and distribution problems could be solved.

Apart from this, the only point of controversy which I see in the article arises from the suggestion that the absorption principle of refrigeration may be considered a serious competitor for what, after all, are reasonably large load applications. Of course, if steam-injector types are to be considered under the heading of absorption machines, no query could possibly be raised, as the steam-injector type is extremely good for large applications, but not very economical for small. However, with the steam injector it must not be overlooked that quite a fair amount of current is used in the circulation systems, and for that matter, where process steam is not available, generation of the steam by electrical means is at least a feasible possibility where current costs justify this method.

The chances of machines other than electrical being used as prime movers is remote, as no air-conditioning plant can be satisfactory unless it is automatically controlled, and from this point of view electrical drive is incomparably cheaper and more satisfactory than any other form.

The subject as a whole is, of course, very difficult to cover in so short an article, but a great deal of information useful to supply engineers may be obtained from the Refrigeration Data Book of the American Society of Refrigeration Engineers. In this, particular examples are given proving that it is possible to estimate quite closely the refrigeration, humidity and heating loads in an air-conditioning system for every building.

Bristol, *April 4th.* F. S. JONES.

Your special number on air conditioning was a most praiseworthy effort and a call to the electrical industry for planned action. The industry is, perhaps, tempted to rest on its oars by virtue of the many electrical heating installations now in use, owing to the feeling that it has won a considerable proportion of the potential heating business which can economically justify electricity as the fuel.

Direct electric heating, while possessing several advantages over solid-fuel, pipe and panel systems, can no longer be considered the ideal system—however cheap electricity may be—for buildings with high occupation densities. Such electric systems take no cognisance of the latent heat proportion of "animal" heat, humidity, air movement and distribution.

The auxiliary air conditioning, pumping and fan loads of high-load factor are most desirable, but complete air conditioning is almost synonymous with recirculation of the inside air, with the addition of a proportion of fresh air. This principle of recirculation will effect a far more marked economy on an electric heater battery than on an air heater battery supplied with steam or hot water from either solid fuel or an electrode boiler. This is obviously due to the rapid control which is possible when direct elements are used.

In brief, the advent of air conditioning for personal comfort reasons has restricted the former field of electric heating equipment, thereby making it incumbent on large supply authorities to apply modern methods of market research for the promotion and advancement of electricity in this new sphere. R. H. WHEAT.

Harrogate, *April 4th.*

Electricity and Air-raid Precautions

The recent publicity given to air-raid precautions prompts one to consider their electrical aspect. From the manufacturing and public works viewpoint, considerations such as duplicate supply, protection of apparatus, and geographical situation have occupied the attention of the authorities for some time. With regard to the maintenance of communications, the recent prominence given to systems of superimposing signals on electrical networks is very interesting. The presence of rediffusion or radio-relay systems operated from batteries has also advantages in an emergency, also not neglecting the claims of the old-fashioned crystal receiver. As the use of crystal sets would prove invaluable during a possible interruption of supply, there is scope for ingenuity on the part of radio-set manufacturers in the way of housing small crystal sets in new receivers.

With regard to the protection of the home by means of gas-proof rooms, those who have put in hand the suggestions in the way of attending to badly fitting doors and windows and skirtings have commented on the improvement in the heating and comfort of such rooms by the exclusion of draughts. In some instances the occupants have been encouraged to carry out similar measures throughout all-electric houses, which has resulted in lower costs for heating.

With regard to domestic electrical fittings, their gas-proof properties would seem to compare very favourably with any other type of installation, providing reasonable precautions are taken. Certainly flush-mounted switches and ceiling roses may be considered gastight if installed correctly, but surface-mounted ceiling roses and switches may need protecting, especially if the latter are fixed on plaster walls having an intervening space. The electric panel fire without chimney breast is obviously ideal and electric inset panel fires and surrounds in houses having chimney breasts are safe, as usually the chimney is then blocked up.

Screwed conduit can be assumed to be almost gastight, but it would appear necessary to seal up the extremities of the tubes. In connection with lighting fittings the possibility of fracture and broken glass has not received much attention, and in this respect there would seem to be less danger from fittings flexibly suspended than from the rigid type. A. R. P.

March 30th.

Overhead Line Construction

I was pleased to note the interest manifested by "J. W." in my article in your journal of March 11th on "Concrete Poles in Rural Areas" and his accompanying questionnaire.

It is comparatively easy to specify stays and insulator prices. The principal conductors used on 33-kV lines are 0.1 sq. in. copper, 0.075 sq. in. steel-cored aluminium, 0.075 sq. in. steel-cored copper, or 7/12 steel. Each of these conductors has a worst load tension in the region of 3,000 lb., so that the stays for terminal and angle positions can easily be determined. The actual type of conductor will make little difference to the insulator design as only the method of binding the conductor to the insulator varies.

The use of a standardised stay wire for all positions is a practice to be admired but avoided. The tension in a stay may vary from approx. 1,000 lb. at a 5 deg. angle to 15,000 lb. at a heavy angle or terminal position. If the number of stays were increased according to the strain, then as many as five would require to be fitted. From the point of view of appearance and also from the consents required for stay positions with the attendant annual wayleave rents, the adoption of two types of stay wire is usual and more economical.

It is necessary to displace shackle poles by 2 ft. 3 in. as this dimension is the distance which the suspension set holds the conductor out from the pole. By displacing the pole, the line of conductors is then in the centre line of the line of route. If this displacement were not adopted then the poles on each side of the shackle pole would be subjected to a side strain which would tend to pull them out of plumb. A standard pole only deals with 2 deg. angles if a $\frac{7}{8}$ in. stay is fitted as indicated in the table incorporated in the article.

The form of construction is suited to 33 kV, because 33 kV is the usual line of demarcation for using pin insulators. Above this, general practice is to change to suspension insulators with consequent re-design. The construction could be used for lower voltages by simply altering the insulators and pins. Conductor spacing is not specified without relation to span length. A basic span of 400 to 450 ft. is employed with the conductors already mentioned and the spacing given meets the requirements.

Mr. E. H. Boulton rather unfairly accuses me of stating in my article that delivery of "bad" poles often occurs. A further scrutiny of my article by him should remove this misapprehension. JOHN MCCOMBE.

Leeds, *April 3rd.*

Factory Lighting

In the building of a factory of average and normal type, what percentage of the total costs should be expended to obtain reasonably good artificial lighting conditions, the allocation to include wiring complete with fittings and lamps.

I use the words "average" and "normal" so as to exclude any special types of factories, and the words "reasonably good" because that is the most usual term used to describe both the qualitative and quantitative valuation of what the technician might put in terms of precise foot-candles.

March 31st. J. M. S.

New Books

Vibration Problems in Engineering. By S. Timoshenko. Pp. 470; figs. 229. 2nd Edition. Constable & Co. Price 24s.

This book is very suitable for finding equations concerning vibrations in various types of engineering structures; it contains excellent references to papers in which more detailed calculations may be found. The opening chapter covers vibrations with one degree of freedom, with and without damping. After dealing with a problem, numerical examples worked out are given. Sometimes it would have been of advantage if intermediate steps in equations had been given to save the reader having to do these mentally.

This is followed by sections on systems with non-linear characteristics, where the natural frequency of vibrations varies with the amplitude, and with variable spring characteristics, such as the oscillation of a string pendulum where the length of the string is altered during the oscillation. One chapter is devoted to systems having several degrees of freedom, and with Lagrange's equations and generalised co-ordinates, but it is far too condensed to be easily followed.

Problems relating to the whirling of shafts (allowing for hysteresis in the iron) and to dynamic vibration absorbers are discussed. Under the latter heading is described how the addition of a weight attached by a flexible suspension to the vibrating body checks the amplitude of resonant vibrations.

A highly mathematical final chapter covers the lengthwise vibrations in rods and complex vibrations of membranes. The appendix is one of the most readable parts, as it describes various vibration-measuring instruments, frequency meters, seismographs, torsion meters, and strain recorders. Only a small selection of instruments is referred to.

Theorie der Wechselstrommaschinen in Vektorieller Darstellung. By Dr. Waldemar Michael. Pp. 272; figs. 210. Leipzig: Verlag B.G. Teubner. Price not stated.

There is much truth in the author's contention that the vectorial treatment of a.c. theory is not so familiar to electrical engineers as it should be, considering its importance and utility. In so far as the characteristics and performance of electrical machinery are concerned, this book gives a thorough and systematic presentation of the subject, but it must be emphasised that it is one for the serious student alone. The author's treatment is very clear and the production of the book leaves nothing to be desired, but only close application on the part of the reader can enable full advantage to be taken of the vectorial methods.

While admitting the utility of equivalent circuit diagrams as an aid to the study of some aspects of a.c. machine theory, the author points out that they afford little or no assistance in visualising the physical conditions of magnetic flux. For this reason, he dispenses with such diagrams and bases his treatment on a co-ordinated use of time-vectors representing the harmonic functions, and space-vectors representing the magnitude and direction of rotating fields. From the basic vectorial equations thus derived for each class of machine, the operating characteristics and loci follow at once.

The first fifty pages of the book are devoted to a useful résumé of the first principles of vector arithmetic and the physical laws relating to a.c. circuits and magnetic fields. The remainder consists of eleven chapters each devoted to one type of electrical machine, synchronous, induction and commutator motors, transformers, convertors, and so on, each of these chapters being arranged on the same plan so far as applicable. Numerical examples are a valuable feature, but the main purpose is a thorough exposition of theory. The book is well indexed and contains a selected bibliography.

Direct and Alternating Current Potentiometer Measurements. By D. C. Gall. Pp. 231; figs. 109. London: Chapman & Hall, Ltd. Price 15s.

Lord Kelvin's opinion that when a thing could be measured we began to know something about it is especially relevant with regard to measurements of current, voltage, frequency and power, which tell us how the object under test behaves under specified conditions, thus permitting us to infer performance under other conditions. Our fundamental instruments, ammeters, voltmeters and wattmeters, demand first consideration when developing sound and reliable calibration means, and the potentiometer, by reason of its simplicity of principle and construction, holds chief place in this class of apparatus.

The present book, which is the fourth of the publishers' series of monographs on electrical engineering, deals with the design of d.c. and a.c. potentiometers and their applications to the calibration of measuring instruments and to a variety of direct measurements. The first chapter deals with the standard cell, the next three with the d.c. potentiometer and its uses, the fifth with galvanometers, the next six with the a.c. potentiometer and its uses, the twelfth with factors governing the choice of a potentiometer circuit. The two concluding are concerned with the representation of alternating currents by complex quantities and a historical note on the potentiometer.

The study ranges from the simplest to the most elaborate forms of potentiometer circuits and it exhibits, as does no other book we know, the value and versatility of what is an assemblage of circuit elements which are essentially simple and fundamental. The designer's difficulties are the high degree of precision demanded from the apparatus, coupled with the manifold uses which have been found for it; in the a.c. types these are complicated by considerations of phase-angle displacement and the inherent lack of an alternating standard cell. How these difficulties have been overcome commercially is described in the book.

Among the many uses to which potentiometers are put may be cited particularly the measurement of earth resistivity, of temperature and of iron loss, instrument-transformer ratio and error measurements, the determination of power-transformer turns ratio and leakage impedance, as a geophysical ratiometer and for the measurement of the constant of high-voltage power lines.

The book is particularly opportune in view of the Electricity Commissioners' document on Approved Apparatus for Testing Stations issued in connection with the 1936 Meters Act. It is a worthy addition to a series which is rapidly making a name for itself.

Television Reception Technique. By P. D. Tyers. Pp. 142; figs. 85. London: Sir Isaac Pitman & Sons, Ltd. Price 12s. 6d.

As the title indicates, this book is limited to the reception side of television, except that it deals with such transmission matters as largely affect reception conditions and design. The subject is treated from the engineering aspect and deliberately omits electron optics and the design of cathode ray tubes. A short glossary given at the beginning is a wise provision and forms a convenient reference for the reader.

The paragraph on short-wave aerials in Chapter I is misleading; but the following chapter on aerial systems gives the fullest and clearest treatment that we have yet seen in any book on television. While the bulk of the book is written lucidly, yet here and there the addition of another word would add to the clarity and obviate a check to the reader unversed in the abbreviated jargon which some television experts adopt. The expression "hard time base" can have more than one meaning to the overworked and tired engineer, whereas the phrase "hard valve time base" is properly understood with the minimum of mental effort.

The number of faults and difficulties of operation that can occur on the vision side far exceed those on the sound side. The author appears to have met with all of them; he methodically describes them one by one, and suggests respective cures. Comprehensive circuit diagrams are given and sketches and constructional data of many of the components peculiar to the vision receiver, while the appendix outlines a newly developed method of scanning.

It is a welcome relief to find that this book excludes all details of purely historical interest which has increased the bulk of so many previous books to the confusion of the reader who endeavours to discriminate between obsolete methods and those that have survived the test of time. Mathematical proofs are likewise omitted and few formulæ included.

The book is unfortunately marred by several errors which should be eliminated before a second edition is published.

Shorter Notices

"Spanish Technical and Engineering Dictionary," by R. L. Guinle. Spanish-English and English-Spanish. Pp. 311. London: Routledge. Price 15s. The fact that Spanish is spoken by some 100,000,000 people, many of whom live in countries which, although well developed, depend largely on Europe for engineering and scientific goods, indicates the importance of a good technical dictionary for the engineering trades. The author of this present work has had over twenty years' experience working for South American Governments, and a special effort has been made to give the exact idiomatic equivalent of English technical expressions. The printing and production are particularly good.

"The Cause of Cancer," by D. Brownlie. Pp. 198. London: Chapman & Hall, Ltd. Price 7s. 6d. This is a provocative book, for the author seeks to present a theory that the primary cause of this malignant disease is the poisonous action of products derived from the decomposition under high-temperature conditions of carbonaceous materials, especially bituminous coal, petroleum oils and all combustion gases, including those employed for cooking. The author himself admits at the outset that his theory has not yet been proved and that clearly research into a subject of this sort would need to be conducted on a scale and with resources beyond those of an ordinary individual.

"*The Autocar* Guide for the 'L' Driver." (22 pp. illus.). London: Iliffe and Sons Ltd. Price 1s. net (by post 1s. 2d.).—This is a revised edition of a useful little booklet of general interest. It covers such matters as the driving test and the licensing regulations, and forms a valuable "coach" for the novice.

"Magneto Manual," by H. R. Langman. Pp. 240; figs. 88. London: Technical Press. Price 6s.

"Electricity," by A. Green. Pp. 221; figs. 207. Price 6s. "Mechanics for Engineering Students," by G. W. Bird and G. W. T. Bird. Pp. 157; figs. 111. Price 5s. London: Sir Isaac Pitman & Sons.

"Electricity and Magnetism," by H. G. Lambert and P. E. Andrews (Pp. 204, figs. 150). University Tutorial Press. Price 2s. 3d.

Registered Electrical Contractors

N.R.E.I.C. report for 1937

THERE was a reduction to 74 in the number of applications accepted during 1937 by the National Register of Electrical Installation Contractors. This was responsible for a decline in the income, according to the report of the Executive Committee. The expenditure rose by about £11, and during the year £1,000 was invested, making the total £7,609.

Of the 123 applications received 56 were accepted, 31 were declined, two withdrawn and 34 remained under investigation. The net number on the Register on March 4th last was 1,723.

A liaison committee has been formed by the Register and the Electrical Contractors' Association and is to hold quarterly meetings to discuss matters of common interest. Following inspection the names of two contractors were removed from the Register and another was reprimanded and gave an undertaking to improve his standard of work. Several technical matters have been dealt with by the Inspection Committee, and contractors have been advised as to the best methods to adopt. It is stated that there is increasing evidence that the list of registered contractors is being made use of by those who desire installation work to be carried out by competent firms. The Register is obtaining greater recognition in Scotland.

The Register does not insist upon compliance with the I.E.E. Regulations, but requires a high standard of work based on the Regulations. Nor does it condemn any particular make or form of appliance or accessory (as has been suggested), but on several occasions it has called attention to the improper fixing of appliances or accessories.

Tribute is paid to the work of the chairman and vice-chairman and to the Local Advisory, Scrutinising and Inspection Committees.

Report on Inspection

The inspectors report an improvement in the standard of applicants' work. Last year 31.6 per cent. of the applications were declined, against 39.8 per cent. in 1936. Altogether 513 inspections were made. This figure included visits to 136 new applicants; satisfactory reports were made in 115 cases; in 144 cases explanations were accepted and undertakings to improve work were given; 108 were second, third or fourth inspections; and ten cases remained under consideration.

In the case of second or subsequent inspections 16.7 per cent. of the contractors have maintained a good standard of work, 19.4 per cent. have shown a marked improvement, 38.9 per cent. some improvement, while 25 per cent. have shown no improvement in their work, which remains at or above the minimum standard acceptable to the Register.

The "educational" value of inspection is stressed in the report and it is said that the inspectors are coming to be regarded as friendly advisers rather than unreasonable critics.

The Annual Meeting

The report and accounts were adopted at the annual meeting on Friday last, when Mr. P. V. Hunter (chairman) presided. Reviewing the financial position, Mr. W. R. Rawlings (hon. treasurer) said that expenses had been reduced to the minimum, but were likely to increase, while the income under the existing system would not. He pointed to the loss incurred in the inspection of the work of applicants. The average cost of these inspections was £5.34, so that by retaining only £2 of the £5 application fee the Register was over £3 out of pocket. He asked if it was not time to consider the retention of a larger amount. On the proposition of Mr. W. M. Selvey, seconded by Mr. A. W. Barham, the Executive Committee was asked to consider this question.

Mr. Rawlings proceeded to say that the Register was still in a strong financial position; the cash and investments were sufficient to cover two years' expenditure. In conclusion, he paid a tribute to the staff.

Mr. P. V. Hunter and Mr. A. H. Dykes were re-elected chairman and vice-chairman respectively. On the Registration Board, Mr. H. Meighan was replaced by Mr. H. M. Speirs, Mr. J. S. Dow by Mr. A. W. Beuttell, and Mr. L. Romero by Mr. H. Breckell. Messrs. A. G. Bruty, Bannister and F. W. Purse were re-elected to the Executive Committee, and the Committee was asked to elect a member in place of Mr. L. Romero, who had resigned.

Mr. Barham suggested that when the inspectors were visiting a town they might find time to approach non-registered contractors to explain the advantages of registration. Mr. H. C. Hazel considered that more might be done by borough electrical engineers to secure registrations. Mr. Purse said that an awkward position might arise if an inspector had to condemn the work of a contractor whom he had persuaded to apply for registration. Mr. H. J. Cash said that the matter was one which should be gone into by the liaison committee formed with the E.C.A., and it was agreed that the Executive Committee should consider the subject.

Parliamentary News (BY OUR SPECIAL REPORTER)

Trolley Vehicles at Bournemouth

A Bill to confirm a provisional order made by the Ministry of Transport for the extension of trolley vehicles in Bournemouth and district was considered last week, March 29th, by a Select Committee of the House of Commons. Sir David Reid presided.

Sir Evan Charteris, K.C., for the Bournemouth Corporation, said the introduction of trolley vehicles had been very successful and so it had been decided to extend and improve the system. At present the layout was uneconomical from the traffic operator's point of view, and unsatisfactory from the point of view of the travelling public. By linking up dead ends and providing circular routes where possible the Corporation hoped to improve the efficiency of the system as a whole. The only opposition came from Christchurch Corporation in respect of one route and the Ministry had decided that that opposition was unreasonable.

The Committee found the preamble proved subject to the elimination of a proposed junction in Christchurch High Street.

Gateshead Trolley Vehicles

Viscount Mersey's committee of the House of Lords resumed last week consideration of the Bills promoted by Gateshead Corporation to obtain power to purchase the tramway system in the borough and convert it to trolley-vehicle working, and by the Gateshead and District Tramways Co., who seek power to abandon the tramways and substitute either trolley vehicles or buses.

Mr. A. C. Baker, general manager of the Birmingham city transport department, who gave evidence on Monday in support of the Bill, said, in answer to further questions by counsel, that he saw no reason why trolley vehicles should not be used in this area. On the contrary, he thought they would be very successful and would be a paying proposition.

In reply to Lord Gifford, a member of the committee, he said it was planned by the Corporation to start with 66 vehicles, and there would be an increased service to the public. The trolley vehicles would be 25 per cent. faster than the tramcars.

Ald. Richard Wayne, chairman of the Transport and Electricity Committee of Newcastle Corporation, said it was their considered policy to substitute trolley vehicles for trams. Through routes between Gateshead and Newcastle should be worked by trolley vehicles in his opinion, and if there was any controversy as to whether trolley vehicles or buses should be used on those routes he would prefer that it should be decided by the Ministry of Transport rather than by an arbitrator. The whole system in the two towns should be under unified control. As the two towns would sooner or later be amalgamated, he favoured the Corporation Bill, because it would be very unsatisfactory to have a company working in one part of the amalgamated area and Corporation working in the other part.

After hearing the final submission on Friday of Mr. Craig Henderson, K.C., for the Gateshead Corporation, that the Corporation should be the traffic authority in its own area, the Committee decided to reject the Corporation Bill, but to allow the Company's Bill to proceed, subject to a clause giving the Gateshead Corporation the right to purchase the undertaking 15 years after the confirmation of a provisional order authorising Newcastle Corporation to run trolley vehicles on the through routes or at the end of any subsequent 10-year period.

Electrical Companies' Pensions Scheme

In the Chancery Division on April 4th Mr. Justice Bennett had before him for the confirmation of the Court resolutions passed by the following companies for the extension of their objects so as to include a contributory pension scheme:—Siemens Electric Lamps & Supplies, Ltd.; Caxton Developments, Ltd.; Alfred Graham & Co., Ltd.; Telephone Installations (London), Ltd.; Submarine Cables, Ltd.; Elliott Bros. (London), Ltd.; and Nalder Bros. & Thompson, Ltd.

Mr. Cecil Turner, for the applicant companies, said they were all subsidiary and very closely allied to the parent company, Siemens Brothers & Co., Ltd., which had already in existence a contributory pension scheme and which embraced some of these subsidiary companies. The purpose of the scheme was that the allied companies should be put in the position to join that scheme or to have some scheme of their own.

His Lordship confirmed the extension of the objects of the companies as requested.

Business and Industrial Notes

The Week's News. Showrooms and Exhibitions. New Installations. Overseas Trade. Publicity Material. Trade Announcements. Prices of Materials. Liquidations and Bankruptcies.

E.D.A.'s Biggest Campaign

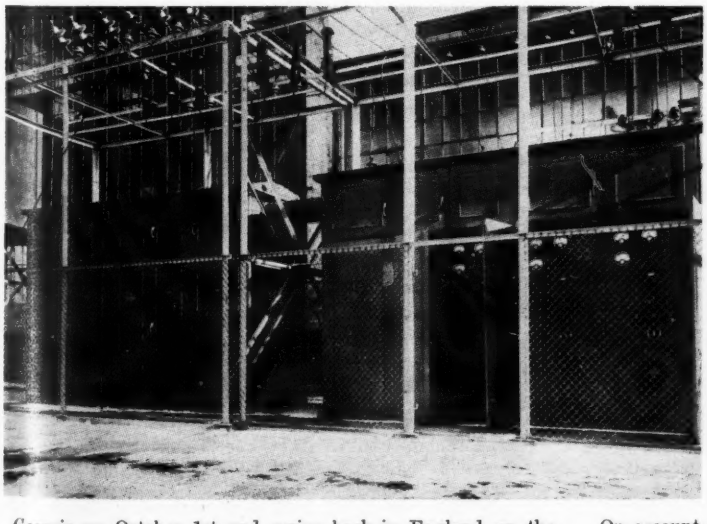
The biggest domestic electrification campaign ever organised by E.D.A. is to be undertaken this year and will include cooking, water heating and extended wiring, separate efforts being made with refrigeration and lighting. In national advertising it is estimated that 300 million messages will reach the public in 200 days, and advertisements will appear regularly in forty national papers. In addition to a new series of local advertisements designed to provide a link with the national advertising, a comprehensive range of 400 general layouts and blocks is available to members. Editorial articles for local papers are suggested, posters are available as well as booklets and a new cookery book. There are three new E.D.A. lectures: "Electricity and Child Welfare," "Hot Water by Wire," and "How to Make the Best Use of Electricity." Where an electric demonstration house is not available it is suggested that a small shop should be taken on a short lease, to supplement demonstrations in existing showrooms. In the "Wiring of Homes" campaign in 1926 four million booklets were circulated. This year E.D.A. hopes for a campaign five times as big.

African Cables Deal

In our issue of March 25th, under this heading, we mentioned the acquisition of the control of African Cables, Ltd., by the Cable Makers' Association. It was suggested that it was unlikely that the plan for the extension of the company's works would be proceeded with. Sir Thomas Purves, Director of the C.M.A., writes to correct this suggestion. He says that this is far from being the position. The transaction by which certain members of the C.M.A. have acquired a majority interest in the South African factory at Vereeniging has been mutually arranged between those members and the South African mining groups which have hitherto controlled the factory and have been the main users of its products. The leading motive of these large mining groups, which still retain a substantial interest in the factory, is that the cables produced there shall be of the highest possible quality and shall fully embody the most recent developments in the art of cable making. It was felt that this could best be secured, now and in the future, by the direct association of the factory with the leading electrical cable manufacturers of Great Britain. In this way the factory obtains the benefit of the special formulæ and processes which have been developed as the result of the wide manufacturing experience and large-scale co-operative research of the members of the C.M.A. So far from restricting the activities of the factory, the C.M.A. is arranging for some of its most expert officers to proceed to South Africa in order to assist the present factory staff to secure the best possible production layout of the factory as a whole and of the new and up-to-date machinery which is now being shipped for its equipment.

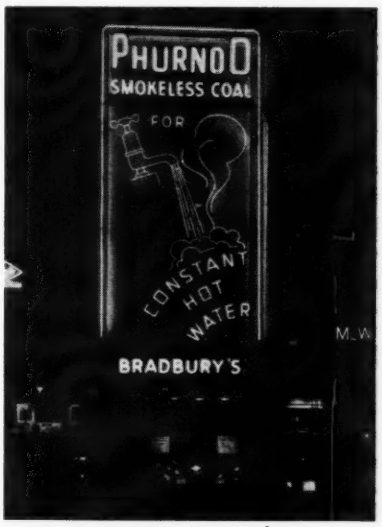
Institute of Vitreous Enamellers

The Council of the Institute of Vitreous Enamellers announces that, subject to a sufficient number of applications being received, an official visit to the United States will be organised to take place in October. This month has been decided upon as the Porcelain Enamel Institute of America is then holding its annual conference and banquet and has issued an invitation to the members of the British Institute to attend this. The party will leave England on the s.s. *Georgic* on October 1st and arrive back in England on the s.s. *Washington* on October 25th. The itinerary will include visits to New York, Baltimore, Washington, Pittsburg, Cleveland, Detroit and Buffalo. Those wishing to join the party can obtain particulars from the hon. secretary, the Institute of Vitreous Enamellers, 42, Napier Court, Hurlingham, London, S.W.6.



An Effective Neon Installation

About 400 ft. of tubing is used for the "Claudgen" neon sign which has been erected on the building of the Powell Duffryn Coal Co., Ltd., Bristol. The letter signs are all in block type teak letters with superimposed tubing, the height of the initial and final letters of "Phurnod" being 3 ft. 3 in. "Phurnod smokeless coal" is illuminated by 15-mm. "Cleora" fluorescent tubing No. 102 (pink); "for constant hot water" superimposed with "Cleora" No. 22 (light green); and "Bradbury's" is superimposed with 15-mm. red tubing. The design of the tap is carried out in "daylight" blue tubing, normal blue tubing being used for the stream of water and bubbles. and "Cleora" fluorescent tubing No. 24 (off-white) for the vapour. The border tube is "Cleora" fluorescent tubing No. 22 (light green). The sign is arranged on a flasher which works on a sequence. While "For constant hot water" is flashing three sets of parallel lines in the centre of the stream of water flash downwards, in conjunction with the three lines of bubbles, at a quick rate, to give the impression of water boiling and bubbling.



A "Claudgen" neon sign at Bristol

Cooking Demonstrations at Erith

On Tuesday last the Erith U.D.C. Electricity Department, in collaboration with the G.E.C., commenced a series of mass electric cooking demonstrations at the Exhibition Hall, Walnut Tree Road. The demonstrations are on similar lines to those which have been given by a number of undertakings in and around London, and include the playlet "Happiness is just around the corner," and Jack Upson and his band. At each demonstration free gifts are distributed.

A Large Canadian Switch Kiosk

What is claimed by the manufacturers to be the largest switchgear kiosk of its kind yet built has been supplied by Crompton Parkinson, Ltd., through Bepco (Canada), Ltd., its Canadian agents, to a motor-car accessory manufacturer at St. Catharines, Ontario. The first section was supplied in 1934 and a second unit was ordered in 1937. The bus-bar system of the two kiosks is connected by trunking, as shown in the illustration, and in all cases the incoming and outgoing connections are taken from the roof of the kiosk by means of bushings. There are eight 15,000-V oil-switch equipments having a tested rupturing capacity of 350 mVA, with space for a further two. The overall dimension of the complete sub-station is 36 ft. 6 in. and the individual kiosks are 16 ft. 6 in. long, 6 ft. 6 in. deep and 11 ft. 9½ in. high. The transportation of the equipment from the Chelmsford works presented many difficulties, as each was shipped in one piece with the oil-switches packed separately. Each kiosk weighed over twelve tons in its crate. On account of the very severe winter weather experienced in the district, provision has been made for heaters so as to maintain a reasonable temperature and prevent freezing.

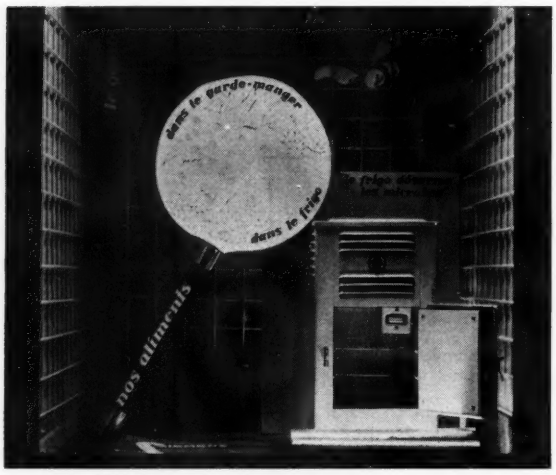
Crompton Parkinson switchgear equipment supplied to a motor-car accessory manufacturer at St. Catherines, Ontario

Easter Holiday Arrangements

Our Advertisement Department ask us to state that on account of the Easter holidays all classified advertisements for next week's issue should reach them not later than 5.30 p.m., Monday, April 11th.

Belgian Window Displays

An interesting part of the development campaign which has recently been carried on by the local electricity company of Malmedy, Belgium, has been the several cleverly arranged



A refrigerator window display at Malmedy

window displays. Generally, each has contained only one or two pieces of apparatus with a sales argument simply and clearly expressed. A refrigerator, set under the paper cut-out of a palm tree, indicated without the need for any further explanation that the apparatus kept foods cool in the hottest weather. A magnifying glass placed in front of a refrigerator and a cut-out of a wire net food cabinet showed the former free from the germs which were seen in the latter. Price was stressed in other cases, as, for example, in the window for electric irons. A single painted iron in the background of an iron display bore the words "30 francs and upwards." In a display of suggestions for electrical gifts each article was shown in a carefully decorated paper box of considerable size.

Orders Recently Booked

In connection with the extensions to the Millgate power station the Stockport Electricity Committee has placed a contract with Simon-Carves, Ltd., for three boilers each having a capacity of 150,000 lb. of steam per hr. The value of the contract is over £250,000. The contract includes tri-drum boilers, economisers, super heaters, air heaters, mechanical stoking plant, draught plant, and auxiliaries, coal handling and storage plant, ash handling plant, and extensions to the buildings. The boilers will have a working pressure of 425 lb. per sq. in., and steam temperature of 800 deg. F.; they will be automatically controlled. The boilers will be installed on the site of the present boiler house and in order to accommodate them certain of the existing boilers are to be dismantled in rotation so as to prevent interruption of the work of the station during the process. The capacity of the new boilers will be 450,000 lb. of steam per hr. and they will replace four existing units having a capacity of 140,000 lb. of steam per hr.

Britannia Batteries, Ltd., has supplied six batteries for substations on the Wirral Railway, the electrification of which has just been inaugurated; also a complete emergency lighting equipment, including battery with automatic control and charging gear for the Tate Gallery, similar to two equipments recently supplied for the British Museum. The company has received an order from the War Office for a locomotive battery of 108 cells of 518 Ah capacity.

Southampton Contractors' Dinner

The annual dinner of the Southampton Branch of the Electrical Contractors' Association was held at the South-Western Hotel on March 30th. The president, Mr. H. E. Walker, in his address, spoke of the progress which had been made. Mr. L. C. Penwill, director and secretary, referred to the problems facing the industry. He invited those sections of the trade who were not parties to the Fair Trading Policy to consider whether the time had not arrived when they should play their part in the deliberations of the Fair Trading Council to establish a basis of fair trading throughout the country. Further, the whole industry should solve the problem of unsafe and dangerous work carried on by the "kerbstoner." The Mayor (Councillor G. E. H. Prince) said he was sorry that the Corporation cut across the private contractor in supplying all kinds of electrical apparatus, which in his opinion should be left to the private trader. Alderman F. R. Brown (chairman of the Electricity Committee) said that it had always been his contention that with so many excellent contractors in Southampton there was no need for the Corporation to meddle in selling appliances. Their primary duty was to supply electricity. The Corporation was considering the question of giving up the hire-purchase of the smaller apparatus.

A "Co-op." Exhibition

Evidence of the large extent to which electricity is used by the Co-operative Wholesale Society and the Royal Arsenal Co-operative Society is a very conspicuous feature of an exhibition which was opened at the Mitcham Stadium on Saturday to celebrate the seventieth anniversary of the formation of the R.A.C.S. Most of the sections representative of the Societies' various manufacturing activities, such as bakery, milk production, egg marketing, confectionery, cloth making, stocking knitting and soap manufacture, include typical equipment used in production and, almost without exception, this is operated electrically. The one exception we did notice was on the confectionery stand where a gas sugar-boiler is used, but this, too, may soon be changed if contemplated experiments with electric heating mature. The C.W.S.'s factory at Dudley provides a large and comprehensive display of "Dudley-Electric" domestic electrical appliances, and there are also on view various makes of refrigerators and radio sets. While the exhibition is in progress—it continues until April 16th—visitors may take the opportunity of visiting the adjoining R.A.C.S. dairy, bakery and laundry, all of which include the most up-to-date electrical equipment.

Manufacturers' Agents

The twenty-ninth annual meeting of the Manufacturers' Agents' Association of Great Britain and Ireland (Inc.) was held at Southern House, Cannon Street Station, on March 29th. About thirty members attended, including representatives from the Scottish and Manchester branches and members from provincial centres. Ald. J. Joy, Master of the Guild of Freemen of the City of London, presided, and in his address stressed the great necessity for increased membership. It was pointed out that whereas some trade organisations had a 100 per cent. membership the manufacturers' agents failed to support their Association. Mr. Joy stated that application had recently been made to the Home Office for the tightening-up of the aliens' registration laws. Foreigners entered this country with alleged agency agreements, many of which were not genuine or of very little importance, and once established here they took over existing agencies of foreign manufacturers from British agents. As a result of this intervention, immigration officers had been instructed to take special precautions. The advisability was urged of having properly drawn-up agreements between manufacturers and agents, and the Association issues such forms of agreements to its members. The Association collected debts from customers and overdue commission and settled disputes between manufacturer and agent, in addition to which the experience of the solicitors attached to the Association was at the disposal of all members in matters of agency law. To aid in increasing the membership one member suggested intensive circularising of all agents or the appointment of canvassers. It was reported that the Association's appeal to the Board of Trade in regard to preferential treatment for agents under the bankruptcy law had been sympathetically heard, but that the law was unlikely to be amended for another few years.

Boston Electrical Exhibition

At an electrical exhibition recently held in Boston, the Boston and District Electric Supply Co., Ltd., played a prominent part. In addition to arranging a display in the main exhibition the company took an adjoining hall, where it

The demonstration stage of the Boston and District Electric Supply Co., Ltd., at the recent local exhibition

staged various demonstrations. The accompanying illustration shows the stage which was erected at one end of the hall. On each side of the hall there were small stands displaying a variety of domestic appliances, and demonstration shop windows showing ordinary and blended lighting.

Social Events

The annual staff dinner of the Enfield Cable Works was held on Saturday last at Chiltern Hall, Baker Street, N.W.1, when the Earl of Verulam, chairman and managing director of the company, presided. In proposing the toast of "The Enfield Cable Works, Ltd.," Mr. D. A. S. Porteous paid a tribute to the memory of the late Mr. G. F. Plutte, managing director, who died last summer, mentioning his interest in the well-being and social activities of the employés. He referred to the progress made by the company during the past year, and expressed the hope that the current year, the jubilee of the company, would prove one on the long road of continuous progress. The Earl of Verulam, in responding, said that when the first annual dinner was held the company was beginning to enjoy prosperity, and during the twelve years which had since elapsed they had never looked back. With the political unrest which was so evident abroad, they should be grateful that the industry had been established in England, where they had that political stability which was essential for success. Mr. F. Plutte proposed the toast of "The Chairman," and the Earl of Verulam suitably responded.

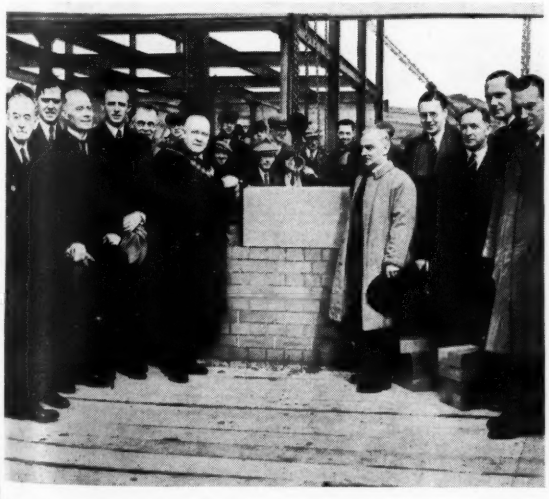
The Social Club of the Woking Electric Supply Co., Ltd., held concerts and socials on March 21st, 22nd and 26th at the company's recreation hall. The events were attended by about 900 employés and their friends. The stage scenery was painted, and the lighting effects carried out by members of the club, and were of a high standard.

At the Connaught Rooms, Kingsway, on April 2nd Mr. G. E. Riley (manager, switchgear sales) and Mrs. Riley presided over a dinner and dance attended by 220 members of the British Thomson-Houston Co.'s Willesden works staff. Mr. T. Hands (Willesden manager), in proposing the health of "Our President," made brief reference to Mr. Riley's very long association with the company. Dancing, which continued until midnight, was enlivened by various ingenious competitions.

The third annual presentation concert of the Telcon Social and Athletic Club (Telegraph Construction and Maintenance Co., Ltd.), was held at the company's works hall, Greenwich, a large number of members and friends attending. As in the previous years, this pleasant informal function took the form of a smoking concert, during which cups and prizes were presented to the winners for various sports including cricket, miniature rifle shooting and various indoor games. Mr. Colin Campbell (chairman of the company), who presented the prizes, said that it was two years ago when he attended the first entertainment of its kind, and the success of the third was an indication of the progress made by the company. He complimented the Committee on the work it had done in making the evening a success. Sir Geoffrey Clarke (managing director), in proposing a vote of thanks to Mr. C. J. C. Padfield, who presided over the proceedings, referred to the value of the club in producing first-class athletes. Major H. Dennison-Pender (director) also spoke. Mr. L. J. Ransom (president of the Club), expressed their thanks to the chairman and directors for attending. One of the most pleasing aspects of the function was that it indicated the collaboration which existed between the directors and those at the head office at Broad Street and the works.

A New Blackburn Factory

The Mayor of Blackburn (Ald. J. Fryars) laid the foundation stone of the new £100,000 factory which is being erected by Philips (Blackburn) Works, Ltd., on a thirty-two acre site at Little Harwood. The event took place on March 30th before



The Mayor of Blackburn laying the foundation stone of Philips' new Blackburn factory. Beside him are Mr. J. Visman (managing director), Sir Alan Hutchings (chairman), and Mr. F. J. Philips (Philips, Eindhoven)

a large gathering which included members of the Town Council and directors of the company. The official party included Sir Alan Hutchings, chairman of the company, Mr. F. J. Philips, a director of Philips, Eindhoven, Holland (the parent company), Mr. H. N. Grundy, Divisional Controller of the Ministry of Labour, and Mr. J. Visman, managing director of Philips (Blackburn) Works, Ltd. Mr. F. J. Philips paid a tribute to the excellent co-operation received at Blackburn, particularly from the Industrial Development Committee, and said that in making the town their choice they had been favourably impressed with the type of labour available. Sir Alan Hutchings said he hoped that the new works would help to reduce Blackburn's unemployment substantially.

Trade Announcements

Evenlite Tube Lamp Developments, Ltd., announces the appointment of Mr. H. M. Robb, managing director of the Cable Lamp Co., 595, Paisley Road West, Glasgow, S.W.1, as its sole agent for distribution of Evenlite products in Scotland.

Ekram Electric, Ltd., has removed to 89, Charlotte Street, London, W.1.

A Disclaimer

With reference to the notice which appeared in our last issue relating to the bankruptcy of J. H. Dollittle, trading as Zenith Radio Manufacturing Co., we are asked by the Zenith Electric Co., Ltd., to state that it has at no time been connected or associated in any way with the Zenith Radio Manufacturing Co.

Manchester Electrical Carnival

With an attendance of about 700, Manchester made a notable success of its first electrical carnival which was held on March 31st at the Ritz Ballroom. The carnival included dancing, supper, cabaret and various competitions, for a number of prizes given by traders and other well-wishers. The proceeds will be given to the E.I.B.A.. All electrical associations in the area participated in the function, and Miss D. Foster Jeffery (E.A.W. organiser) was joint secretary with Mr. R. C. Hawkins, N.W. England and N. Wales Area Officer of E.D.A.

Prices of Materials

The following prices are only general, and they may vary according to quantities and other circumstances:—

CHEMICALS, ETC.	Price April 6th.	Fortnight's Inc. or dec.
a Acid Oxalic ... ... per cwt.	50s.	—
a Ammoniac, Sal ... ... per ton	£36	—
a Ammonia, Muriate (large crystal)... ,,	£18 10s.	—
a Borax ... ... ,,	£17	—
a Copper, Sulphate ... ... ,,	£22 10s.	—
a Potash, Chlorate ... ... per lb.	3½d. to 4½d.	—
a ,, Perchlorate ... ... ,,	6d.	—
a Shellac ... ... per cwt.	£4 18s.	—
a Sulphur, Commercial ... ... per ton	£11	—
a ,, Roll... ... ... ,,	£11	—
a Soda, Chlorate ... ... per lb.	3½d. to 3¾d.	—
a ,, Crystals ... ... per ton	£5 to £5 5s.	—
a Sodium Bichromate, casks ... ... per lb.	4d. net.	—
METALS, ETC.		
b Aluminium, Ingots ... ... per ton	£100 to £105	—
b ,, Wire ... ... per lb.	1/1 to 1/9	—
b ,, Sheet and Foil... ... ... ,,	1/3 to 2/9	—
p Babbitts Metal and Anti-friction Metals—		
Grade I ... ... per ton net	£168	£9 dec.
Grade II ... ... ,,	£120	£5 dec.
Grade III... ... ... ,,	£70	£2 dec.
c Brass (rolled metal 2" to 12" basis)... per lb.	7¾d.	¼d. dec.
c ,, Tubes (solid drawn) ... ... ,,	11d. to 11¼d.	¼d. dec.
c ,, Wire, basis ... ... ,,	8¼d.	¼d. dec.
c Copper Tubes (solid drawn) ... ,,	1/0¼	¼d. dec.
g ,, Bars (best selected)... ... per ton	£73	£2 dec.
g ,, Sheet... ... ... ,,		
g ,, Rod ... ... ,,		
d ,, (Electrolytic) Bars ... ... ,,	£43 15s.	15s. dec.
d ,, ,, Wire Rods ... ,,	£48 5s.	15s. dec.
d ,, ,, H.C. Wire ... per lb.	7½d.	⅛d. dec.
f Ebonite Rod ½" dia. & up ... ... ,,	1/10 to 2/5	—
f ,, Sheet ⅛" thick & up ... ,,	1/5 to 1/10	—
n German Silver Wire, Nos. 1 to 12... ,,	2/4	—
h Gutta-percha, fine ... ... ,,	nom.	—
h India-rubber, Para-fine ... ... ,,	5 7/16d.	1/16d. dec.
i Iron, Pig (Cleveland, No. 3) ... per ton	£4 5s.	—
i ,, Wire galv. No. 1 P.O. Qual.... ,,	£23	—
g Lead, English Pig ... ... ,,	£17 15s.	£1 dec.
g Mercury ... ... per bot.	£12 10s.	—
e Mica (in original cases) small ... per lb.	10d. to 2/–	—
e ,, ,, ,, medium ... ,,	6/– to 12/6	—
e ,, ,, ,, large ... ,,	13/– to 17/6 up	—
p Phosphor Bronze, plain castings ... ,,	1/2½	—
p ,, ,, drawn bars & rods ,,	1/1½	—
p ,, ,, rolled strip & sheet ,,	10½d.	—
p ,, ,, wire ... ... ,,	1/0½	—
o Platinum ... ... per oz.	£7 10s.	—
d Silicium Bronze Wire ... ... per lb.	8½d.	½d. dec.
g Spelter ... ... per ton	£13 10s.	£1 3s. 9d. dec.
g Tin, Block (English)... ... ... per ton	£168 5s.	£17 5s. dec.
n ,, Wire, Nos. 1 to 16 ... ... per lb.	4/3	—

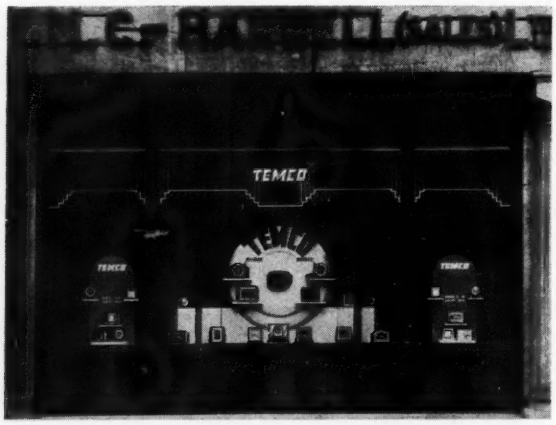
Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India Rubber, Gutta Percha and Telegraph Works Co., Ltd.
g Henry Gardner & Co., Ltd.
h Edward Till & Co.
i Bolling & Lowe.
n P. Ormiston & Sons.
o Johnson Matthey & Co.
p C. Clifford & Sons, Ltd.

The above table is published here fortnightly. In alternate issues, in which it does not appear, the latest prices of copper, silicium bronze wire, lead, rubber, tin and spelter, up to the time of going to press, are given in our "Business Notes" under the same heading.

Electric Clock Publicity

The accompanying illustration shows a display of "Temco" synchronous electric clocks in the Shaftesbury Avenue window of T.M.C.-Harwell (Sales), Ltd. The small glass case in the centre foreground houses a special stripped movement unit,



A window display of "Temco" synchronous electric clocks

and its works are made visible by an ingeniously arranged mirror.

The company has embarked upon a "Temco" synchronous clock test publicity campaign. The campaign, which commenced in South Yorkshire on March 24th, will continue until the end of May, and will include advertisements in the provincial Press, the distribution of broadsheets and catalogues to wholesalers, contractors, retailers, watchmakers and jewellers, &c., and showcards and window-display units. The campaign is the first step towards large-scale national advertising.

The G.E.C. Players

The G.E.C. Dramatic Society gave its annual performances on Monday and Tuesday last at the Fortune Theatre, London, in aid of the Infants' Hospital, Westminster, and chose on this occasion "Spring Tide," by George Billam and J. B. Priestley. This play, which deals with the fluctuating fortunes of the residents of a Kensington boarding house, gives plenty of scope for characterisation and its successful production depends largely upon skilful portrayal and all-round team work. This society has given evidence so often in the past of these qualities that we were not surprised to see how the members of the cast slipped into their parts with that ease and polish born of long experience. All the principal players maintained the high standard which they have themselves set, while Mr. F. Lewis and Mr. H. Castledine, in lesser parts, were great successes.

Machine-Tool Operation

A course of training for toolmakers is being given by German instructors at the works of E. H. Jones (Machine Tools), Ltd., Edgware Road, N.W.9, and will continue until April 12th. The equipment consists of a complete range of Thiel machines and about 100 men from various works in England are receiving instruction.

New Catalogues and Lists

G. Becker, Ltd., Exhibition Grounds, Wembley.—A catalogue of switches, plugs, sockets, &c.

Marconi-Ekco Instruments, Ltd., Electra House, Victoria Embankment, London, W.C.2.—Two leaflets dealing with a beat frequency oscillator and precision capacity bridge.

Londex, Ltd., Brettenham House, Strand, London, W.C.2.—Leaflets dealing with a time delay relay, a short period time switch and a synchronous motor-driven contact maker.

British Aluminium Co., Ltd., Adelaide House, London, E.C.4.—Booklets entitled "Aluminium Foundry Data" and "Aluminium Finishing Processes."

L. G. Hawkins & Co., Ltd., 30/35, Drury Lane, London, W.C.2.—A folder giving a "pre-view" of the company's advertisements for the summer campaign.

Kryn & Lahy (1928), Ltd., Coburn Works, Letchworth.—An illustrated booklet giving details of "KL Stronger Steel" castings.

W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, London, E.C.1.—Leaflet R.W.1, giving details of the "Sharborn" relay for remote and automatic control of low-voltage a.c. circuits.

Davis Bros. (Illuminating Engineers), Ltd., 22, Buckingham Street, Strand, London, W.C.2.—An illustrated booklet (Pp. 48) dealing with stage lighting equipment, bus-bar chambers, trunking, and outdoor floodlighting.

Enfield Cable Works, Ltd., 296/302, High Holborn, London, W.C.2.—An 82-page catalogue of rubber-insulated cables.

Nevelin Electric Co., Ltd., Purley Way, Croydon.—A leaflet on glass bulb rectifiers.

Veritys, Ltd., Plume and Victoria Works, Aston, Birmingham, 6.—An illustrated 96-page catalogue of switch and control gear.

Smith's English Clocks, Ltd., Cricklewood Works, London, N.W.1.—A booklet setting out the merits of electric clocks, a new style of literature for the clock trade. Several new models for both domestic and business use are listed.

Hackbridge Electric Construction Co., Ltd., Walton-on-Thames.—Technical leaflets describing on-load tap-changing equipment and terminal arrangements.

Phosphor Bronze Co., Ltd., 54, St. Thomas Street, London, S.E.1.—A booklet on "Bound Brook" oil-less graphite and bronze bearings.

Time Switches & Instruments, Ltd., 120, Victoria Street, London, S.W.1.—A leaflet giving details of type "SuA" time switch.

Private Arrangements

Stokes of Southgate, radio and electrical engineers, 4, Dennis Parade, Southgate.—At a recent meeting of the creditors it was stated that an informal meeting of the principal creditors had previously been held when a statement of affairs was submitted showing unsecured creditors, £957; expenses, £63; and preferential claims, £40. The assets consisted mainly of stock, at cost, £900, and book debts £250. It was suggested to the creditors that they should assent to a composition deed under which they would receive 3s. 6d. in the £ immediately, 2s. 6d. on June 30th, 2s. on September 30th, 3s. on October 31st, 3s. on November 30th, 3s. on December 31st, and 3s. on January 31st, 1939. The creditors decided that, subject to satisfactory arrangements being made with an execution creditor, the debtor should execute a deed of composition in favour of Mr. A. E. Attwood, of 119, Finsbury Pavement, London, E.C., and a committee was also appointed.

A. D. Moulder and **G. K. Jones,** trading as Moulder & Jones, 14, Clifton Street, Cardiff, electrical contractors and wireless dealers.—A meeting of the creditors was held recently at the offices of Poppleton & Appleby, 35, Windsor Place, Cardiff, when the joint statement of affairs showed liabilities of £2,044. The net assets were £480, leaving a deficiency of £1,564. The separate estate of A. D. Moulder showed liabilities of £32, with a deficiency of £30, and that of G. K. Jones disclosed liabilities of £16 and no assets. The creditors decided that the deed of assignment already executed to Mr. L. S. Findlay, of Poppleton & Appleby, should be confirmed, and a committee was appointed.

A. E. Crisell, trading as B.C. & E. Radio, 528/530, Garratt Lane, Tooting, London, S.W., radio engineer.—At the recent meeting of the creditors it was stated that no up-to-date figures were available, but according to a balance sheet as at February 28th, 1938, the liabilities amounted to £573. The assets totalled £431. The creditors decided that a deed of assignment should be executed to Mr. N. Osborne, of 11, Finsbury Square, London, E.C., as trustee.

Bankruptcy Proceedings

H. P. Ansell, trading in partnership with others as H. P. Ansell & Partners, and also trading in partnership with another as Engineering Services at First Avenue House, High Holborn, electrical consultant and lately trading in partnership with others as H. P. Ansell & Partners, at City Chambers, Broad Street, Birmingham.—This debtor attended the London Bankruptcy Court for his public examination before Mr. Registrar Kean on March 30th. Debtor's statement of affairs disclosed liabilities of £605 and assets of £518. Replying to the Official Receiver he stated that in September, 1935, he commenced business as an electrical engineer from his parents' residence and later moved to First Avenue House, W.C. In November, 1936, as the business was increasingly successful, he took into partnership his father and three others and registered the firm as H. P. Ansell & Partners, First Avenue House. At the same time a provincial office was opened at Birmingham. In July, 1937, he registered a company with a capital of £500 to carry out a contract for the manufacture of metal closures for milk cartons. Subsequently owing to disagreement among the partners and a decline in the number of contracts financial difficulties were experienced. Finally, a private creditor obtained judgment against him and he decided to file his petition. The examination was concluded.

R. R. French (Radio Electrical Services), Chandos Place, St. Austell.—Receiving order made March 25th on debtor's own petition. First meeting April 9th at 12, Princes Street, Truro. Public examination April 25th at the Town Hall, Truro.

A. Reid, radio specialist, 1, Bridge Street, Neston, Chester.—Public examination May 4th at the Court House, Pilgrim Street, Birkenhead.

J. Bolton, wireless dealer, 88 and 90, Bolton Road, Blackburn.—Receiving order made March 29th on debtor's own petition. First meeting April 13th at 7, Lord Street West, Blackburn. Public examination May 11th at the County Court House, Blackburn.

A. T. White, electrical engineer, Radio House, High Street, Hadlow.—Receiving order made March 29th on debtor's own petition.

Company Liquidations

Regal Radio Co., Ltd.—Meetings April 27th at 128, Romford Road, Stratford, E.15, to receive an account of the winding-up by the liquidator, Mr. W. S. F. Stagg.

F. J. Gunnell, Ltd., radio dealers, High Street, Banstead, Surrey.—The statutory meeting of creditors was held on March 25th at Cheam, when the statement of affairs showed liabilities of £102 and net assets of £21, leaving a deficiency of £81. Mr. E. A. Sale, accountant, 23, Brocks Drive, North Cheam, Surrey, was nominated to act as liquidator of the company.

Great Eastern Electric Co., Ltd.—Winding up voluntarily. Liquidator, Mr. P. A. Houstoun, 36, Clapton Common, E.5. This is a members' voluntary liquidation and all creditors will be paid in full.

Cleeolectric Vehicles, Ltd.—Meeting May 2nd at 1b, Halford Street, Leicester, to receive an account of the winding-up by the liquidator, Mr. E. W. King.

Dissolution of Partnership

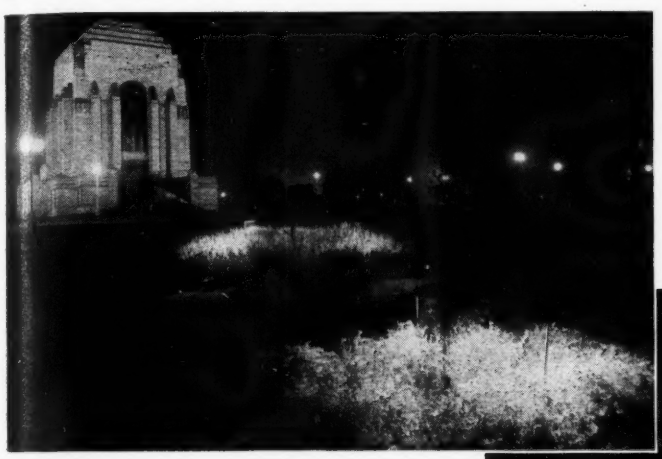
James Hill & Son, electrical engineers and contractors, 24, Brazennose Street, Manchester.—Messrs. J. Hill and J. C. Hill have dissolved partnership. The business will be carried on under the above title by Mr. J. C. Hill.

Electricity Supply

Lighting, Domestic, Power

Australia.—150TH ANNIVERSARY CELEBRATIONS.—The accompanying photographs of illuminations in Sydney during Australia's 150th anniversary celebrations are two of a number which we have received from Mr. W. Riley, electricity sales superintendent to the Sydney County Council. Red, orange, amber, green and blue special colour glasses were used for the lighting of the trees, and some 470 tree floodlights and 200 garden plot reflectors were installed in Hyde Park and various other smaller parks. In addition, trees and shrubs were floodlighted in colour in the Domain, the Botanical Gardens and on the harbour front. Mercury floodlights were used for the harbour bridge, with the pylons picked out in orange.

EXTENSIONS AT ALBURY.—Our Australian correspondent reports that an important programme of extensions has been



Sydney illuminations: Garden lighting in Hyde Park, with the Anzac Memorial in the background, and (below) the harbour bridge

adopted by the Albury Council with the object of linking adjacent country centres and farms with the local network, which is supplied in bulk by the Victorian Electricity Commission. The Council recently agreed to borrow £7,000 to extend the service 10 miles south to Jindera, and to supply settlements around Ettamogah and the Hume Reservoir, and also farmers and graziers living between these points. Already 200 applications for supplies have been received, and the work, which will cover an area of 25 miles, will start as soon as the formal consent of the State Government has been secured.

QUEENSLAND ELECTRICITY COMMISSION.—Mr. S. F. Cochran, assistant under-secretary in the Chief Secretary's Department, is to be chairman of the new State Electricity Commission, and Mr. A. E. Axon, M.E., A.M.I.E.E., A.M.I.E. (Aust.), a leading Brisbane consulting engineer, and Mr. S. J. Bryan, State secretary of the Electrical Trades Union, will be offered appointments on the Commission. Mr. G. S. Ross, accountant to the Public Works Department, may be the fourth member.

Bettws-y-Coed.—SALE OF UNDERTAKING.—A decision has been reached by the Urban District Council to sell the municipally owned electricity undertaking to the North Wales Power Co. The Council obtained its Lighting Order in 1906, but an electricity supply was not provided until 1914. The capital expenditure was £7,136. Generation is from Elsi Lake—the source of the town's water supply, and there is an emergency motor-generator plant. It is understood that the Power Co. will renew the system. The old Elsi Lake hydro-electric plant will be abandoned and mains will be extended from Llanrwst to Bettws-y-Coed. Larger distribution cables will now be laid and the voltage increased from 110 to 230 V. The cost of the extension of the main supply from Llanrwst and the alterations

Birkenhead.—SUB-STATION.—The Corporation is to erect a sub-station in Rake Lane By-pass, Upton.

Borrowdale.—NEW ELECTRICITY SCHEME.—Following the abandonment of the original Honister and Borrowdale scheme it was stated at the recent quarterly meeting of the Parish Council that the Electricity Commissioners were considering the supply of electricity to the Dale by a different route.

Brixham.—OPPOSITION TO BILL WITHDRAWN.—The Urban District Council has withdrawn the petition lodged against the Brixham Gas and Electricity Bill. The Bill, the purpose of which is to authorise the Brixham Gas and Electricity Co. to raise additional capital, will be considered by the House of Commons Committee on Unopposed Bills on April 7th.

Cheltenham.—NEW EQUIPMENT.—The Electricity Committee is to provide additional transformers and switchgear at various sub-stations at a total estimated cost of £2,093.

Corby (Northants).—STREET LIGHTING.—Improved street lighting for the whole length of the main streets in Corby is proposed by the Parish Council, and estimates from Kettering Electricity Department and Kettering Gas Co. are now under consideration. The Council has already assumed the responsibility for the lighting of roads on Stewarts and Lloyds housing estates which have been taken over by the County Council, and has improved the lighting in High Street.

Darlington.—RURAL SUPPLIES.—The Electricity Committee has decided to provide a supply of electricity for the villages of Neasham and Drinkfield.

Finchley.—WIRING BY CONTRACTORS.—Arrangements have been concluded for approved contractors to carry out wiring for the Electricity Department at an average price of £2 12s. 6d. per cooker, £1 12s. 6d. for all large water-heater and immersion-heater installations and £2 per installation for wiring and water connection of small water heaters.

LOAN.—The Electricity Committee is applying for permission to borrow £50,000 for mains and services.

STREET LIGHTING.—Following a petition by residents in Chapel Street, East Finchley, lighting in the street is to be converted from gas to electricity.

Foxearth (Suffolk).—SUPPLY PROPOSED.—The East Anglian Electric Supply Co. is to extend its services to the village. During the past year fifty villages were added to the company's supply network.

France.—GENERATION IN 1937.—The renewal of industrial activity in the country was reflected in the output of electric power in France during the past year. According to the *Revue Générale de l'Electricité*, this reached 12,554.6 million kWh, as compared with 11,433.4 million kWh in 1936, an increase of 10 per cent. Hydro-electric production advanced from 7,674.8 million to 8,646.4 million kWh (13 per cent.).

POSITION OF THE ELECTRICAL INDUSTRY.—A rather dark picture of the present situation of the electrical industry is drawn by the annual report of the Syndicate of Electrical Producers and Distributors in France. Although there has been less tendency to burden the electrical industry with new expenses than in 1936, the results of the various laws and decrees have continued to handicap the industry. In connection with the rate index, for instance, the formula introduced is said to be slow in its application and with the cost of coal and other materials rising the companies have to sustain considerable losses between when the rise in cost takes place and when they are permitted to raise their charges to cover it. Furthermore, the five-day week in industry, by reducing the period of utilisation of plant, has introduced a new unfavourable factor. There is also the legal obligation imposed on the companies to proceed with rural electrification, whereas France, it is claimed, has been electrified very nearly to the limit of economic possibility.

Germany.—ELECTRICITY PRODUCTION.—Statistics have been issued concerning the development of the production of electricity in Germany in the past five years, based on the monthly output of 122 works. In 1933 these works produced 14,210 million kWh, and the amount has grown to 26,230 million kWh in 1937.

Glasgow.—ELECTRIC HEATING.—The Health Committee is to renew the wiring and heating equipment in bedrooms in the nurses' home at Maryhill Hospital at a cost of £4,000.

SUB-STATION.—The Clyde Valley Electrical Power Co., Ltd., is to erect a sub-station at Woodlands Road, Thornliebank.

ELECTRICITY AT THE EXHIBITION.—The manager of the Empire Exhibition has advised the Electricity Committee that the demand for electricity at the Exhibition is now expected to reach 11,300 kW instead of 7,000 kW, as originally estimated, and consequently the Exhibition authorities desire the Corporation to provide additional transformers, switchgear and cables, for which a payment of £2,570 will be made.

Guildford.—POWER STATION'S FUTURE.—Expert advice is to be obtained in view of the decision of the Electricity Commissioners to refuse their consent to the extension of the generating station.

Inverness.—BULK SUPPLY UNDER CONSIDERATION.—It is understood that the Grampian Electricity Supply Co. is being asked to reconsider its previous terms regarding a partial bulk supply to the electricity undertaking with a view to the Town Council tackling the problem that has arisen owing to the refusal of the Electricity Commissioners to authorise a proposal for the introduction of extra generating plant. If no agreement is reached between the Grampian Supply Co. and the Council it is expected that the latter will renew its application to the Commissioners.

Ipswich.—PROPOSED NEW GENERATING STATION.—At a meeting on March 30th the Town Council authorised the Electric Supply and Transport Committee to draw up a scheme for a large generating station on a site on the River Orwell between Cliff Quay and the sewage outfall works. Consulting engineers are to be engaged to draw up a plan which will be submitted to the Central Electricity Board.

Italy.—POWER PRODUCTION.—According to *L'Energia Elettrica*, the production of electricity in Italy last year reached a total of 14,960 million kWh, as compared with 13,563 million kWh in 1936, an increase of 10 per cent. The output included 14,391 million kWh from hydro-electric stations.

Lancaster.—LOWER CHARGES.—The Electricity Committee has decided that the discount within the city only on all accounts for electricity (except contracts) paid within 28 days of demand shall be increased from 10 to 12½ per cent. It is also to reduce the flat rate in the rural area from 9d. to 8d. per kWh; the "unit" charge on the "electric home" tariff in the rural area to 0.4d. per kWh; the prepayment-meter tariff from 9d. to 8d. per kWh; and the "unit" charge of the "all-in" tariff for farmers from ¾d. to ½d. per kWh.

London.—SOUTHWARK.—The Electricity Committee is seeking sanction to borrow £5,211 for specified works and £12,500 for unspecified works. A slight reduction is to be made in the hire charges for cleaned and reconditioned cookers, which at present cost the same as new cookers, for an experimental period of six months. Owing to the high rate of depreciation on kettles it has been considered advisable to make a slight increase in the charges for new kettles.

Manchester.—FEEDER EXTENSIONS.—The Electricity Committee is to extend feeder mains at a cost of £8,500.

Mansfield.—EQUIPMENT ON HIRE.—It has been decided to let domestic apparatus out on hire on the following terms: Standard cookers, 5s. a quarter; large cookers, 7s. 6d. a quarter; 1½-gal. sink heaters and thermostatic immersion heaters, 3s. 6d. a quarter.

Morecambe.—PRIZE FOR PRIVATE ILLUMINATIONS.—The Carnival Committee has offered the carnival trophy to the Corporation for use in connection with a suggested prize scheme for encouraging private illuminations. The Illuminations Committee is to consider the proposal and report upon the basis of a maximum allocation of £100.

COOKER MAINTENANCE.—Where cookers are purchased outright a maintenance service over the same period as covered by the usual hire-purchase terms is to be offered on payment of an additional amount equivalent to 5 per cent. of the retail price.

SUB-STATION.—The Electricity Committee is to construct a sub-station to service the Figure 8 Park area at a cost of £3,550.

Nayland (Essex).—STREET LIGHTING.—A tender of the East Anglian Electric Supply Co. for the lighting of the village has been accepted by the Parish Council.

Newark-on-Trent.—BETTER LIGHTING.—The electrical engineer (Mr. R. E. Livesley) has submitted a scheme for the improvement of the lighting on the main roads of the borough, and a sub-committee has been appointed to consider the proposals with a view to obtaining the Ministry of Transport grant.

Newcastle-upon-Tyne.—AIR-RAID PRECAUTIONS.—The City Air-Raids Precautions Committee is investigating the possibility of using electricity supply cables for alarm signals during air raids. The fact that Newcastle secures its electricity supply from two sources will cause difficulty.

North Berwick.—PRICE REDUCTIONS.—Last week the Town Council decided to reduce the lighting flat rate from 7d. to 6d. per kWh and the industrial power rate from 3d. to 2d. per kWh. The tariff of the Electricity Department (engineer, Mr. E. T. Pound) is now as follows: Lighting, 6d.; power, 2d. and 1d.; heating, 3d. and 1d.; domestic step rate system, a quota of kWh according to floor area of house (outside measurement) at the lighting rate, then a similar quota at 3d., and all in excess at 1d. per kWh; business premises, as with domestic, but with the quota based on 300 kWh per kW of installed lighting; industrial power, a quota of 300 kWh per kW of installed motors or apparatus at 2d. per kWh and all in excess at 1d.; and water heating (summer), ¾d. per kWh.

Peterborough.—EXTENSIONS.—Mains extensions are to be carried out to a new estate off Garton End Road.

PROTEST AGAINST ERECTION OF POWER STATION.—The City Council is to protest to the Central Electricity Board against the erection of the new power station at Little Barford, near St. Neots. It contends that by an extension of the Peterborough power station production would be cheaper.

St. Austell.—ELECTRICITY CHARGES REDUCED.—As from July 1st next the charge for electricity under the St. Austell and District Electric Lighting and Power Co.'s all-purposes tariff will be reduced from 1d. to ¾d. per kWh.

Scarborough.—TRANSFORMER.—The Town Council is to replace the 200 kVA transformer at the Peasholm sub-station with another of 300 kVA.

Stanley (Co. Durham).—ELECTRICITY CHEAPER.—The electricity charges have been reduced by the Urban District Council as from April 1st. For domestic premises the new rate is 5d. per kWh for the first 27 kWh and 1½d. per kWh for additional energy; for prepayment slot meters the first 27 kWh is charged at 7d. and further consumption at 1½d.; for power supplies (where separately metered) the first 27 kWh is charged at 3d., with additional consumption at 1½d. per kWh.

Stirling.—The Town Council is borrowing £6,005 for buildings and plant at the sub-station in Drip Road.

Stoke-on-Trent.—MAINS.—The Electricity Committee is to provide mains and equipment for a sub-station in Uttoxeter Road, Meir, at a cost of £2,100. It is also to provide a supply to the gravel pits and other premises of Naybro Stone, Ltd., at Lightwood, at a cost of £1,300. Extensions to mains are to be carried out at a cost of £4,200 at Penkull, chiefly to afford a supply to the research laboratory of the British Pottery Manufacturers' Association in Queen's Road. An additional supply is to be given at a cost of £450 to electric kilns at the pottery of John Maddock & Son, Ltd., in Newcastle Street, Burslem. At a cost of £2,250 a supply is to be afforded to the Glebe colliery of Fenton Collieries, Ltd.

Sutton.—INN FLOODLIGHTING.—The recently introduced luminescent electric-discharge lamps have already found applications in widely different fields, including floodlighting. Some buildings lend themselves particularly well to such

"Sieray" luminescent lamps are used for the floodlighting of the Plough Hotel, Sutton Common

treatment, and when the floodlighting is planned wisely the appearance at night is extremely good and attracts attention from near and far. The accompanying photograph shows such an installation recently completed by S. Rogers & Co., Ltd., at the Plough Hotel, Sutton Common. Siemens 400-W luminescent "Sieray" lamps are housed in units of pleasing design and unobtrusive appearance.

Sutton Coldfield.—CHANGE-OVER AT STREETLY.—The Electricity Committee is to convert a large part of the Streetly d.c. system to a.c. at a cost of £5,804.

PROPOSED CREMATORIUM.—In connection with the provision of a chapel and crematorium in the new cemetery the borough surveyor is to prepare plans and obtain particulars regarding gas, electric, coke and oil furnaces.

SUPPLY IMPROVEMENTS.—The Electricity Committee is to improve the supply to the Whitehouse Common estate and district at a cost of £7,165.

Swinton and Pendlebury.—SUB-STATION.—The Electricity Department proposes to erect a sub-station in Barton Road, Swinton.

Whitburn.—NEW ROAD LIGHTING.—An up-to-date lighting installation has recently been provided in Sea Lane. The equipment consists of B.T.H. 400-W "Mercra" electric-discharge lamps in horizontal lanterns, the average spacing of the units along the 30 ft. road being 150 ft., staggered on straight stretches and on the outside of curves. The installation was designed by the B.T.H. Co. and the North-Eastern Electric Supply Co., Ltd., in collaboration with Mr. N. Hindmarsh, surveyor to the Boldon Urban District Council. Law & Burns, of South Shields, erected the lamps, and Callender's Cable & Construction Co., Ltd., were the contractors for cabling and servicing.

York.—OVERHEAD SYSTEM.—Application is being made by the Electricity Committee for permission to operate the following sections of the York overhead high-voltage system without connections to earth, *viz.*, all 11,000-V lines north of the village of Nun Monkton on the west side of the River Ouse and all 11,000-V lines east of a line drawn from Stockton-on-Forest to the village of Farlington.

Traction

Bingley.—TROLLEY-BUSES.—A start is to be made this month on the erection of poles for the new trolley-bus system through the Council's area. The present tramway system of the Bingley Urban District Council is leased to the Bradford Corporation.

Gateshead.—TRANSPORT UNDERTAKING'S POSITION.—No comment has been made at Gateshead on the decision of a Select Committee in the House of Lords (see page 510) to reject the Bill promoted by Gateshead Corporation relating to the purchase of the undertaking of the Gateshead and District Tramways Co., which is promoting a Bill seeking to replace the present trams by trolley-buses. The Town Clerk of Gateshead (Mr. J. W. Porter) stated that they had had no time to consider the position fully, but other steps would be taken. Alderman Richard Mayne (chairman of Newcastle Transport and Electricity Committee) said Newcastle's position had been strengthened as a result of the decision. The position now was that the question lay only between the Newcastle Council and the Gateshead Tramways Co. The company had granted certain concessions and had agreed to operate trolley-buses and that in the case of an extended service of such vehicles it would operate them in conjunction with the transport system of Newcastle.

L.N.E.R.—COLOUR-LIGHT SIGNALLING.—Callender's Cable and Construction Co., Ltd., has recently completed a contract for the General Railway Signal Co. in connection with the colour-light signalling installation between Shenfield and Southend. The work consisted of the supply, erection and jointing of over 23 miles of multi-core paper-insulated cables between stations, signalling points and distribution boxes; 18 miles of twin power cable to carry the 660-V supply, which is transformed and rectified at signalling points to d.c. at 30, 25 and 10 V (for the operation of relays between Billericay and Southend stations); and 500 yd. of rubber cable for branch connections, the largest type having seventy-one conductors. Rubber-insulated cable was used for making connections between the p.i. cable and the signalling apparatus, it being undesirable to connect paper-insulated cables directly to the terminals of the mechanism. Other materials used included 18,250 steel supporting stakes weighing about 19 tons, with 1,350 hangers, supporting 37,000 yd. of steel-stranded catenary wire. For connecting up of the terminal boards in the signal cabins Callender's supplied special flame-proof cable.

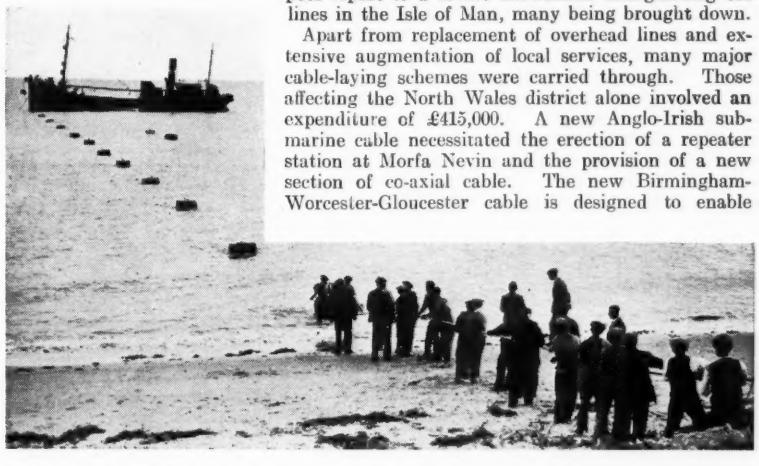
South Africa.—RAILWAY ELECTRIFICATION AND RURAL SUPPLIES.—Recent extensions of the electrified lines of the South African Railways and Harbours Administration have opened up possibilities of large areas in rural districts being supplied with electricity many years before this would normally have been possible. These extensions are in the Natal, Orange Free State and Transvaal areas, and have resulted in an 88,000-V transmission line being brought from Durban to Volksrust. The traction sub-stations supply energy transformed down to 6,600 V to small distribution networks. Power for the railways is obtained from the Electricity Supply Commission. The Commission already supplies a number of small farming districts, and there is no doubt that many others within an economic distance of the sub-stations will shortly be included.

TROLLEY-BUSES.—The first part of Durban's "five-year plan" to improve its civic amenities will be the substitution of trolley-buses for the existing tramcar service from the Post Office to Umbilo. Tenders are called for the supply of seventeen trolley-buses at an estimated cost of £56,100 and overhead equipment at a cost of £9,200.

Telephone Changes and Progress

CO-ORDINATION of the commercial and engineering sides of the telephone service under telephone managers is recorded in several of the area reports for 1937. Certain adjustment of boundaries has also taken place which makes it difficult to determine exactly the extent of the progress during the year, but that a considerable expansion has taken place is readily discernible.

In the Chester telephone district (North Wales survey district), of which Mr. H. Faulkner is superintending engineer, the number of exchange lines at the end of last year (42,483) was only 648 fewer than a year before, although 5,585 lines were transferred on July 1st. In the Birmingham area, of which Mr. Faulkner is also superintending engineer, no readjustment is mentioned and the increase of 7.7 per cent., to 128,551, in the number of telephone stations is consequently a fair comparison, as is the expansion of 10 per cent., to 114 million, in calls originated in the area.



One of the major telephone projects carried out last year was the laying of new cables between the British Isles and Northern Ireland. The photograph reproduced shows one of the cables being floated ashore at Donaghadee, Co. Down

In the Manchester district (superintending engineer, Mr. A. Morris) the number of telephones increased from 119,439 to 133,103, and after deducting the 6,502 taken over the net increase is 6 per cent. In the Liverpool area Mr. Morris reports certain transfers to and from other districts, but it is not clear what effect these changes have on the position. It is pointed out, however, that the number of new orders for telephones (16,721) was considerably higher than for any previous year and 56 per cent. more than in 1936. At the end of last year the total number of telephone stations was 100,398, an increase of 9.7 per cent. A similar proportionate increase (9.3 per cent.) is shown by Mr. A. Wright in his report on the North Midland district, where the number of telephone stations at the end of last year was 133,124.

Conversion of exchanges to automatic operation continued in all districts. Within seven miles of Birmingham the exchanges operating automatically served 76 per cent. of the subscribers, and at the end of the year the conversion of the Birmingham Central exchange was nearly completed. At Manchester the number of automatic subscribers' lines within seven miles was 80 per cent. of the total. The conversion of the Liverpool service to automatic operation is requiring a comprehensive cabling network linking up the Wirral exchanges with the new automatic centre at Lancaster House.

Another phase of activity during the year was the replacement of overhead lines by underground equipment. At September 31st the total underground mileage in the Birmingham area was 585,900 and overhead 35,300; for the Chester district the figures were 279,000 and 81,200. The disadvantage of overhead equipment is demonstrated by a reference in the Liverpool report to a severe snowstorm disorganising 600 lines in the Isle of Man, many being brought down.

Apart from replacement of overhead lines and extensive augmentation of local services, many major cable-laying schemes were carried through. Those affecting the North Wales district alone involved an expenditure of £415,000. A new Anglo-Irish submarine cable necessitated the erection of a repeater station at Morfa Nevin and the provision of a new section of co-axial cable. The new Birmingham-Worcester-Gloucester cable is designed to enable twelve circuits to be obtained on one pair of conductors, repeater stations being provided at intervals of seven miles. Other important schemes referred to include many long-distance cables, among them those between London and Derby, *via* Northampton and Leicester, and London and Manchester, *via* Birmingham.

Other Services

Mention is also made in the reports of continued progress in the development of the telex and teleprinter services. In the telegraph surveys it is revealed that the upward tendency of traffic following the introduction of the sixpenny telegram in 1935 has been maintained. The number of telegrams originated in Birmingham last year was approximately 6 per cent. more than in 1936, in the North Wales area traffic improved by 6.5 per cent., and in the North Midlands a slight increase is recorded. In Manchester telegraph transactions dealt with decreased by 2.3 per cent., which is stated to be due to the provision of more direct circuits having reduced transmission through the city. Among new voice-frequency systems was that between Manchester and London—the fifth between these towns—which is solely for teleprinter private hire services.

Contract Information

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Contracts Open

Aberdeen.—April 13th. Governors of Robert Gordon's College. Electrical and heating installation for Seafield Playing Field pavilion extension. Secretary, Schoolhill.

Barking.—May 2nd. Borough Council. Electrical installations for Manor Selective School. (See this issue.)

Bath.—April 18th. City Council. Materials for twelve months. (April 1st.)

Belfast.—April 22nd. Electricity Department. Pipework for steam supply, steam separator and fire extinguishing equipment for the Harbour power station. (See this issue.)

Birkenhead.—April 19th. Borough Council. Stores for twelve months. (April 1st.)

Birmingham.—April 25th. General Purposes Committee. Electric thermal storage, panel warming and plenum ventilation for proposed block of municipal offices. Town Clerk, Room 30b, The Council House (deposit £5 5s.).

Bridlington.—April 11th. Town Council. Two neon signs for Grand Pavilion and Royal Princes Parade. (April 1st.)

Bristol.—April 20th. Electricity Department. L.v. substation switchgear and 6.6-kV and 11-kV switchgear. (See this issue.)

Dumfries.—April 14th. County Council. Electrical work at Moffat Rest House. County Clerk, County Buildings.

East Ham.—May 7th. Electricity Department. Electrically operated steam and hot-water supply system for the Public Baths. (See this issue.)

Eire.—DUBLIN.—April 26th. Port and Docks Board. One four-ton level luffing electric portal wharf crane. The Secretary, Port and Docks Office, Westmoreland Street.

Grantown-on-Spey.—April 19th. Town Council. Complete electric street lighting installation for the town. G. C. McLean, Electricity Works, Waterloo Place, Inverness.

Gravesend.—April 20th. Electricity Department. E.h.v. switchgear, transformers and kiosk. (See this issue.)

Hoylake.—April 14th. Electricity Department. House service electricity meters. (April 1st.)

India.—BENGAL.—April 26th. Bengal and North Western Railway Co. Two motor-driven air compressors. (April 1st.)

Kettering.—April 29th. Electricity Department. Renewal of certain plates of existing battery. (April 1st.)

Kingston-upon-Thames.—April 30th. Electricity Committee. Meter-testing equipment. (See this issue.)

Kirkcaldy.—April 18th. Electricity Department. House service meters, cooker control units and aluminium utensils for twelve months. (See this issue.)

Leyton.—April 14th. Electricity Department. One 500-kVA transformer and e.h.v. switchgear. (April 1st.)

Littleborough.—April 9th. U.D.C. Four sets of electrically driven, vertical, unchokeable centrifugal sewage pumps, including automatic starters, switchboard and wiring. Clerk to the Council, Council Offices (deposit £2).

London.—STEPNEY.—April 25th. Electricity Supply Undertaking. Transformers, switchgear, distribution units and street pillars for twelve months. (April 1st.)
April 13th. India Stores Department, Belvedere Road, S.E.1. Ten 100-kVA and ten 200-kVA distribution transformers (deposit 5s.).

Manchester.—April 20th. Electricity Committee. Glass shades, time switches, a.c. motors, kettles and meters for twelve months. (See this issue.)

Mexborough.—April 18th. Electricity Department. E.h.v. and l.v. cables for twelve months. (See this issue.)

Morley.—April 21st. Housing Committee. Wiring and electric lighting installation at Fairfax Avenue estate (thirty-nine houses) and Whitehall Grove estate (thirty houses). Town Clerk, Town Hall (deposit £2 2s.).

New Zealand.—WELLINGTON.—May 24th. Posts and Telegraph Department. Condensers. (T. 19917/38.)*
June 3rd. 120,000 1.5-V telephone cells. (T. 19918/38.)*

Portsmouth.—April 19th. Electricity Undertaking. E.h.v. and l.v. sub-station switchgear and steel kiosks with switchgear. (March 25th.)
May 2nd. Electricity Undertaking. One 1,080-Ah, 62-cell battery. (See this issue.)

Pudsey.—April 26th. L.v. underground cables. (See this issue.)

Seaham.—April 11th. U.D.C. Underground cable, bare copper strand and wood poles. J. S. Forster, Electric House, Blandford Place.

Shipley.—April 14th. Electricity Department. E.h.v. and l.v. cables. (April 1st.)

South Africa.—JOHANNESBURG.—April 16th. City Council. Screwed electrical conduit for twelve months. (T.Y. 19504/38.)*
April 25th. Railways and Harbours Administration. One twenty-ton electric travelling crane. (T. 19507/38.)*
PRETORIA.—April 28th. Union Tender and Supplies Board. Air-conditioning plant for the East London automatic telephone exchange (Cape Province). (T. 19732/38.)*

Spenborough.—April 11th. Electricity Department. One 1,250-kVA (alternatively, 1,500-kVA) transformer. (April 1st.)

Stockport.—April 14th. Electricity Department. Central evaporation plant, boiler feed water pumps and l.v., a.c. switchboard for auxiliary plant at Millgate sub-station. (April 1st.)

Sunderland.—North-Eastern Housing Association. Electrical installation for seventy-eight flats at High Street East. J. E. Lewis, Town Hall.

Swindon.—April 12th. Electricity Department. One sheet steel kiosk sub-station with e.h.v. equipment. (March 25th.)

Tiverton.—April 9th. Borough Council. Electrically driven reciprocating pumping plant and filtration plant. Town Clerk.

Wallasey.—April 19th. Borough Council. Single-phase (indoor and street-pit type) transformers. (March 25th.)

Warrington.—April 19th. Electricity Department. Transformers. (April 1st.)
April 20th. Health Committee. Electric refrigerators, lifts, emergency lighting equipment, and radio equipment for the Borough General Hospital. (See this issue.)

West Hartlepool.—April 20th. Electricity Department. Three 300-kVA, single-phase transformers. (April 1st.)

* Further particulars from the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, London, S.W.1.

Contracts Closed

Aberdeen.—County Council. Accepted. Electrical work in twenty-eight houses at Waterton.—R. A. Mair.

Barking.—Electricity Committee. Recommended. Street-lighting equipment (£894).—Revo Electric Co. Six sub-station boards (£299).—Siemens Bros. Twelve feeder pillars (£469).—Henley's. H.v. switchgear for Gale Street sub-station (£214).—A. Reyrolle & Co. H.v. switchgear for Wykenham Green sub-station (£166).—Ferguson, Pailin.

Birkenhead.—Electricity Committee. Accepted for twelve months. Transformers.—G.E.C. H.v. switchgear.—Crompton Parkinson; Ferguson, Pailin; G.E.C.; Met.-Vick. Electl. Co.; A. Reyrolle & Co.; Switchgear & Cowans. L.v. switchgear.—Crompton Parkinson; G.E.C. L.v. fuse gear.—W. Lucy & Co. Lamps.—Commercial Electric Co.; Ensign Lamps; J. Montador; Splendor Lamp Co.; J. Stott & Son (Electric); Tungstalite.

Glasgow.—Transport Committee. Accepted. Extraction plant.—Sturtevant Engineering Co. Neon tubing.—Roland Trading Co.

Hampton.—Metropolitan Water Board. Accepted. Electric cable and fittings for waterworks (£823).—Henley's.

Kincardineshire.—Education Committee. Accepted. Electrical installation in new school at Inverbervie (£92).—A. McRobb.

London.—L.C.C.—Wiring and fittings for electric lighting, clock, power, telephone and door-bell systems in the laboratory, mortuary, &c., at Lambeth Hospital:—

	£		£
L. G. Tate & Co. Accepted ...	**1,032**	W. Steward & Co.	1,133
Francis Polden & Co.	1,039	Davis Myer & Co.	1,192
Samuel Reed & Sons	1,058	Bower Engineering Works (Electrical and General)	1,230
Springvale Electrical Co. ...	1,065	F. Troy & Co.	1,250
Pemberton and Sturgess (Great Britain)	1,072	Collins Electrical	1,303
A. Meckhonik	1,087		

Middlesex.—Health Committee. Accepted. Electric platform trucks (£493).—Wingrove & Rogers.

Morecambe.—Electricity Committee. Accepted. Two potentiometers (£92 and £65).—Cambridge Instrument Co. Polyphase test set (£719), wattmeters (£100), and one rotating substandard (£46).—British Sangamo Co. Batteries (£29).—Britannia Batteries.

Newark-on-Trent.—Electricity Committee. Accepted. P.i. cable (£194).—B.I. Cables.

Salford.—Electricity Committee. Recommended. Oil circuit-breaker (£286).—Ferguson, Pailin.

Sheffield.—Electricity Committee. Accepted. Cables for twelve months.—W. T. Glover & Co. Switchgear for Bayley's Steel Works (£3,065).—A. Reyrolle & Co.

Shipley.—Housing Committee. Accepted in lieu of withdrawn tender. Electrical installations in fifteen houses (£143).—J. Pierson.

Warrington.—Electricity Committee. Accepted. Meter testing equipment.—Met.-Vick. Electrical Co.

York.—Electricity Committee. Recommended. H.v. cables (£15,092).—Callender's.

Our Service Department

EVERY day inquiries of all kinds are received by the Editors, the bulk of them relating to the producers of specified classes of electrical goods. We are able to reply to most of these with the aid of our extensive records, but in a few cases we have to seek the assistance of our readers. This week we have been asked for the names and addresses of manufacturers of the following:—

L. & P. tubelight lamps.
ASTEX fittings.

Readers should enclose stamped addressed envelopes when making their inquiries.

Forthcoming Events

Institution of Electrical Engineers.—Monday, April 11th. Institution, London, W.C.2. 7 p.m. Informal meeting. Discussion on "Air Conditioning." To be opened by Mr. R. J. C. Barrington.

Transmission Section.—Wednesday, April 13th. Institution, London, W.C.2. 6 p.m. "The Surge Protection of Power Transformers." Messrs. J. L. Miller and J. M. Thomson.

North-Eastern Centre.—Monday, April 11th. The Newe House, Newcastle-on-Tyne. 6.15 p.m. Annual general meeting. "The London Television Service." Messrs. T. C. Macnamara and D. C. Birkinshaw.

Western Centre.—Monday, April 11th. Merchant Venturers' Technical College, Bristol. 6 p.m. "Rural Electrification." Mr. J. S. Pickles.

North-Western Centre.—Tuesday, April 12th. Engineers' Club, Manchester. 7.15 p.m. Annual general meeting. "The Surge Protection of Power Transformers." Messrs. J. L. Miller and J. M. Thomson.

Scottish Centre.—Tuesday, April 12th. 39, Elmbank Crescent, Glasgow, C.2. 7.30 p.m. Annual general meeting. "The Trend of Design of Electric Locomotives." Mr. C. E. Fairburn.

Hampshire Sub-Centre.—Wednesday, April 13th. The Municipal College, Portsmouth. 7.30 p.m. Short papers.

Institution of Engineers-in-Charge.—Friday, April 8th. Holborn Restaurant, London, W.C.2. 6 for 6.30 p.m. Annual dinner.

Electrical Industries Benevolent Association.—Friday, April 8th. Savoy Hotel, London, W.C.2. 12 noon. Luncheon and annual meeting.

Physical Society.—Friday, April 8th. Imperial College of Science and Technology, South Kensington, S.W.7. 5.15 p.m. Short papers.

Association of Mining Electrical Engineers (*South Wales Branch*).—Saturday, April 9th. Cardiff. Three short papers on "Underground Illumination in Mines."

Illuminating Engineering Society.—Tuesday, April 12th. Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W.1. 7 p.m. "Luminescent Materials and Their Application to Light Sources." Mr. W. J. Ryde.

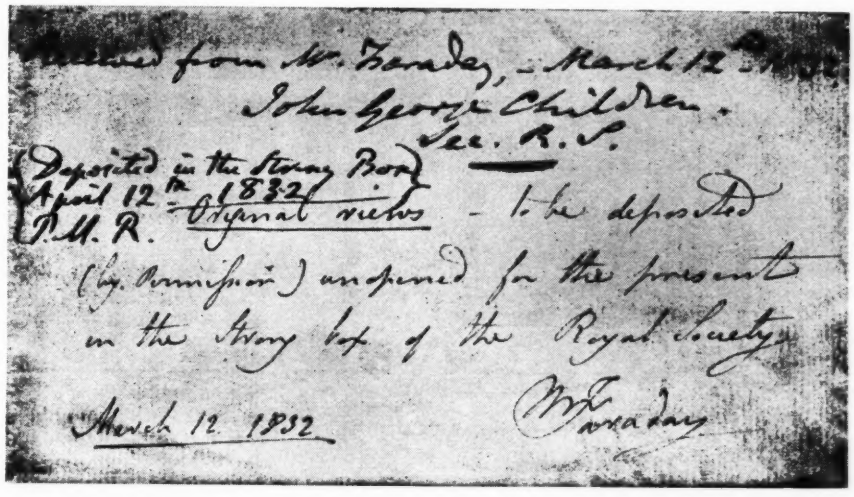
Association of Supervising Electrical Engineers.—Tuesday, April 12th. 2, Savoy Hill, London, W.C.2. 7.15 p.m. "Electric Water Heating." Mr. P. Honey.

Notes

Faraday and Electro-magnetic Waves

In 1865 Clerk Maxwell showed by mathematical means that electro-magnetism is propagated through space in the form of waves travelling with the velocity of light. This theory was confirmed twenty-three years later by Hertz when he experimentally produced electro-magnetic waves, thus providing the basis for radio.

While the credit for the first working out of the relationship between light and electro-magnetic radiation belongs to Maxwell, the original idea of wave motion must be attributed to Faraday, as is clear from a document dated March 12th, 1832, which was deposited a month later with the Royal Society and remained sealed until it was opened recently. In this Faraday compared the diffusion of magnetic forces with "vibrations upon the surface of disturbed water or those of air in the phenomena of sound" suggesting that the vibratory theory would apply most probably to light and "by analogy . . . . to the phenomena of induction of electricity also."


Received from Mr. Faraday, March 12 1832
John George Children.
Sec. R.S.
Deposited in the Strong Box
April 12th 1832
R.M.R.
Original rules - to be deposited
(by permission) unopened for the present
in the Strong box of the Royal Society
March 12. 1832
M. Faraday

The envelope deposited by Faraday with the Royal Society in 1832

His purpose in setting down his views and sealing the paper was to secure his claim to privacy until he could support this hypothesis by experiments, thus preventing any risk of his claim being disputed if his work were observed by others. With the relatively crude apparatus then available, Faraday was unable to test practically his theory that magnetic action "requires time for its transmission," but the document now made public after more than a century establishes his claim as the father of the idea of the time element and wave propagation of electro-magnetic forces.

Sub-station Visit

A large party of members of the Association of Supervising Electrical Engineers, visited the Streatham high-voltage substation of the County of London Electric Supply Co., Ltd., on March 26th. The party was received by Mr. W. Gibbs, supervisory control engineer, who, with his assistant, conducted the members through the various buildings and gave a detailed description of the equipment and its operation.

"Review" Volumes Offered

One of our readers tells us that he has a number of bound volumes of the ELECTRICAL REVIEW which he thinks would be of greater service in a reference library than in his office. The volumes cover the period January, 1899, to December, 1927. Will any interested parties communicate with us?

E.I.B.A. Sussex Centre

The annual ball organised by the Sussex Centre of the Electrical Industries Benevolent Association will be held on April 22nd at the Grand Hotel, Brighton. Tickets (10s. single, 15s. double) can be obtained from the hon. organising secretary, Mr. B. S. H. Warde, Cryselco, Ltd., 59, Ship Street, Brighton.

E.A.W. Activities

The Newcastle branch of the E.A.W. held its annual dinner-dance on March 25th, the guest of honour being Lord Eustace Percy, rector of King's College, Newcastle-on-Tyne. Miss C. Haslett said that the E.A.W. now had eighty-two branches throughout the country.

Speakers at the luncheon at the Park Lane Hotel, London, on Thursday, April 28th, in connection with the Annual Conference, will be the Rt. Hon. E. Leslie Burgin, M.P., Minister of Transport; Sir Cyril Hurcomb, Chairman of the Electricity Commission; Viscountess Astor, M.P. and the Dowager Lady Swaythling, who will also preside.

Some 120 senior demonstrators and saleswomen are now attending a special three-days' course at the E.A.W. headquarters arranged jointly by E.D.A., the E.A.W. and E.L.M.A.

Three short sketches "Me and My Diary," and "How Now the Brown Cow," both by Gertrude Jennings; and "Members of the Jury," by Stuart Ready, were presented by the Association's Dramatic Circle on Wednesday.

I.E.E. Transmission Section

The Committee of the Transmission Section of the Institution of Electrical Engineers has arranged a week-end visit to Belgium from May 13th-17th. The Union des Exploitations Electriques in Belgique, in conjunction with the Association des Centrales Electriques Industrielles de Belgique are making the arrangements in Belgium. The visit will include a conference on the work of the Societé Anonyme Union des Centrales Electriques Linalux and its power stations, inspection of sections of the S.A.U.C.E. Linalux, a visit to the blast-furnace-gas power station of Messrs. John Cockerill at Seraing, and a visit to the Schelle power station. Full particulars and application form can be obtained from Mr. P. F. Rowell, secretary of the Institution, Savoy Place, London, W.C.2.

Chief Engineers' Salaries

A conference of representatives of local authorities in the North-Western Area held in Manchester on March 29th under the chairmanship of Sir Thomas E. Higham approved of the setting up of the proposed Joint Committee for dealing with questions relating to salaries and conditions of service of chief electrical engineers. The following were appointed to be district employers' representatives:—Alderman J. R. Potts (Carlisle), Alderman W. Walker (Manchester), Alderman C. Sawyer (Fleetwood), Councillor J. Selwyn Jones (Newton-in-Makerfield), Councillor E. T. Roberts (Crewe) and Councillor P. Winstanley (Wigan).

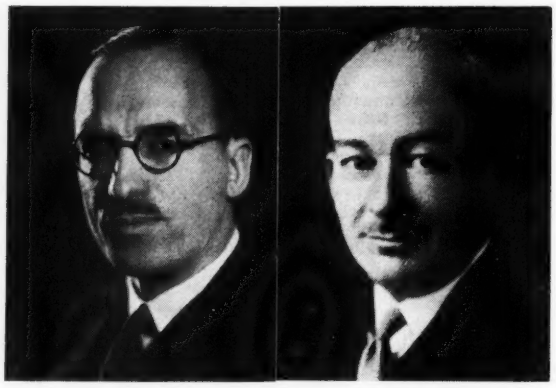
The A.M.E.E. Annual Convention

The annual convention of the Association of Mining Electrical Engineers will be held in Glasgow from June 7th-10th. On the first day there will be a golf competition and an informal reception in the Grand Hotel. The Empire Exhibition will be visited on the following day, and on the third day there will be a day's sail on the River Clyde. The Council meeting will be held on the last day, in the morning, and in the evening there will be a reception, dinner and dance at the Central Hotel, Glasgow.

Our Personal Column

Electrical men are invited to keep readers of the "Electrical Review" posted concerning their movements

Mr. V. Z. de Ferranti, chairman and managing director of Ferranti, Ltd., was elected chairman of the Council of the British Electrical and Allied Manufacturers' Association at



Mr. V. Z. de Ferranti Mr. J. L. Wilson

the recent annual meeting. **Mr. J. L. Wilson,** director and sales manager of the British Thomson-Houston Co., Ltd., is vice-chairman.

Mr. A. F. Neal, B.Sc., A.M.I.E.E., assistant chief engineer of the Manchester Corporation Transport Department, is recommended for the post of deputy manager of the Edinburgh Transport Department. The appointment will be submitted to the Town Council for approval at its next meeting. Mr. Neal has held his present post since 1934. A student at King's College, London University, he became a student-apprentice in the Dick Kerr Works, Preston, in 1920. Six years later he became technical engineer for tramways with the English Electric Co., Ltd., and four years later was personal assistant to the works manager of both engineering and body-building departments. He joined the Manchester Corporation in 1931 as senior assistant engineer in the rolling-stock section.

Mr. C. A. Weekes, the legal secretary and secretary to the Council of the British Electrical and Allied Manufacturers' Association, is retiring from that position. Mr. Weekes, who is a barrister-at-law, was born in Dublin and was educated at the High School, Dublin, Trinity College, Dublin, and the Law School of the King's Inns, Dublin. He came to London in 1896 and for a number of years was engaged in journalism and editorial work. In 1905, at the invitation of the late Mr. D. N. Dunlop, he joined the then British Westinghouse Co. at Norfolk Street, Strand. He was associated with Mr. N. Carleton, who later became president of the Western Union Telegraph Co. Mr. Weekes left the Westinghouse Co. in 1911, with Mr. Dunlop, to take up the organisation of B.E.A.M.A. He, and the late Mr. T. Trimnell (industrial solicitor to the Association), between them, built up the whole tradition of B.E.A.M.A. conditions of sale and the organisation which enables members to obtain satisfactory settlements on nearly every electrical contract. In addition, he has been responsible for dealing with the many questions and difficulties which arise and have to be dealt with by the staff of B.E.A.M.A., legal and other matters. **Miss J. Brewis,** another member of the original permanent staff of the Association, is also retiring. She joined originally as the late Mr. Dunlop's personal secretary, and has been responsible for the comfort and welfare of the staff.

Mr. C. A. Weekes

Mr. H. A. S. Dunk, A.M.I.E.E., change-over engineer with the Borough of Finchley Electricity Department, has been appointed assistant distribution engineer with the Metropolitan Electric Supply Co.

Mr. H. W. Swann, Senior Electrical Inspector of Factories, is a member of the Electricity Commissioners' Committee appointed to investigate the question of fire risks at generating stations, etc. His name was inadvertently omitted from the summary of the Committee's report in our last issue.

Mr. W. T. Langfield, A.M.I.E.E., of the Bath Corporation Electricity Department, has been appointed mains superintendent with the Beckenham Borough Council.

Mr. S. T. Heskins has resigned from T. Clarke & Co., Ltd., and has been appointed manager of the Contracts Department of the Springvale Electrical Co., Brentford. Mr. Heskins was with T. Clarke & Co., Ltd., for over thirty years, where he commenced as a junior and was successively electrician, foreman, and supervising engineer, being responsible for the estimating, supervision and successful carrying out of some of their largest contracts and for the past few years he was a director. Mr. Heskins served throughout the war in the Royal Navy, and was present at the Battle of Jutland in H.M.S. *Princess Royal*, in the electrical section.

[*Ricardo, Hounslow.*
Mr. S. T. Heskins

Mr. R. H. Gummer, a special director of International Combustion, Ltd., has been elected president of the Batti-Wallahs' Society for 1938, in succession to Sir Thomas Purves.

[*Elliott & Fry*
Mr. A. Pickersgill

Mr. A. Pickersgill, A.M.I.E.E., who has had control of the electricity undertaking of the former Cleckheaton, and present Spenborough Urban District Council, since the inauguration of the works thirty-six years ago, has retired on superannuation. Previously, Mr. Pickersgill was for over thirteen years assistant electrical engineer at Dewsbury. His Spenborough fellow officials, and also members of the Cleckheaton Conservative Club, have presented him with tokens of appreciation and good will.

Dr. Robert E. Doherty, President of the Carnegie Institute of Technology, Pittsburg, has been awarded the 1937 Lamme Medal by the American Institute of Electrical Engineers "for his extension of the theory of alternating-current machinery; his skill in introducing that theory into practice and his encouragement of young men to aspire to excellence in this field." Dr. Doherty is widely known in American electrical engineering work and is an authority on technical education. He was for many years with the American General Electric Co., and from 1931 to 1936 professor of electrical engineering at Yale.

Mr. F. J. Wright, formerly of Crompton Parkinson, Ltd., has been appointed Yorkshire area manager for Ensign Lamps, Ltd., which has opened a branch depôt at 74, Wellington Street, Leeds, to cope with the increasing demand for its lamps in Yorkshire.

Mr. F. J. Wright

The Hull Corporation Electricity Committee has considered the vacancy which will occur when **Mr. J. N. Waite,** the general manager and engineer of the Electricity Department, takes up his new duties at the end of June as district manager for South-East England to the Central Electricity Board, and has decided in favour of dividing the offices held by him. According to the *Yorkshire Post*, the Committee states that, having regard to the control of generation now exercised by the Central Electricity Board, the commercial side of the undertaking merits most consideration from the Corporation's point of view, and it recommends that **Mr. D. Bellamy,** the present deputy commercial manager, be appointed general manager at a salary of £1,250 per annum, rising to £1,500, and **Mr. C. I. Shuttleworth,** the present deputy electrical engineer, be appointed chief engineer at a salary of £1,150, rising to £1,250. Mr. Waite's salary as general manager and engineer is £2,400 per annum.

Mr. F. M. Bruce, King's College, Newcastle-on-Tyne, has been nominated for the chairmanship of the North-Eastern

Students' Section of the Institution of Electrical Engineers for the 1938-39 session.

Mr. G. Barnard, advisory director and Midlands district manager of Callender's Cable and Construction Co., Ltd., has completed fifty years of outside contract work for the company and fifty-six years service in all, having celebrated his jubilee in April, 1932. A report of the celebrations appeared in the Electrical Review at that time.

Mr. W. C. Lusk, chairman of the British Thomson-Houston Co., Ltd., deputy-chairman and managing director of Associated Electrical Industries, Ltd., and a director of a number of other companies, has applied to the Home Secretary for naturalisation. Mr. Lusk is an American citizen, but has resided in this country for a number of years.

Mr. W. E. Schall, B.Sc., has been nominated as president of the British Institute of Radiology (Röntgen Society) for the ensuing session.

Vice-Admiral Sir Charles R. Carpendale has retired from the B.B.C. after fifteen years' service. Sir Charles has been deputy director-general since 1935.

Sir Ronald Wilfred Matthews, J.P., and **Sir Richard Arthur Pease,** Bt., have joined the board of the Brush Electrical Engineering Co., Ltd.

The marriage took place at the Castle Church, Stafford, on April 4th of **Mr. W. E. Milton Ayres,** M.I.E.E., M.A.I.E.E., of Tixall Road, Stafford, and Miss Agnes Rosener Winson, elder daughter of Mr. and Mrs. Ernest W. Winson, of Kingston-on-Thames. Both the bride and bridegroom have been associated with the Stafford Works of the English Electric Co. Ltd., the former as welfare superintendent and captain of the Fencing Club and the latter as a leading designer with the company.

Mr. A. Marsh has been nominated for the chairmanship of the North Midland Students' Section of the Institution of Electrical Engineers for the 1938-39 session.

Obituary

Mr. F. R. C. Rouse.—We regret to record the death of Mr. F. R. C. Rouse, A.M.I.E.E., M.I.Mech.E., general manager of Venner Time Switches, Ltd., which occurred on April 5th at the age of fifty-five. Mr. Rouse, who had been with Venner Time Switches, Ltd., from its earliest days, was a student at the Finsbury Technical College and had since been hon. secretary of the Finsbury Technical College Old Students' Association. He was a member of the Worshipful Company of Clockmakers.

The late Mr. F. R. C. Rouse

Mr. K. B. Thornton.—The death is announced in *Electrical News and Engineering* of Mr. Kenneth B. Thornton, general manager of the Montreal Tramways Co., which occurred recently at the age of sixty-four. A native of Montreal he received his education at the City of London and University College School and the Central Technical College, South Kensington. He returned to Canada in 1893 and had held positions with the Montreal Light, Heat & Power Consolidated, J. G. White & Co., of New York, the Canadian Light & Power Co., and the Quebec, New England Hydro-Electric Corporation, before joining the Montreal Tramways Co.

Will.—Lord Rutherford, O.M., F.R.S., Cavendish Professor of Experimental Physics at Cambridge, left £7,402, with net personalty £6,231.

Financial Section

New Companies. Official Returns of Capital. Debenture Charges. Reports of Electrical Companies. Dividend Announcements. Transactions in Stocks and Shares

New Companies Registered

Gardner Brothers (Electrical), Ltd.—Private company. Registered March 31st. Capital, £1,000. Objects: To acquire the business of an electrical contractor and manufacturer and seller of electrical, radio and gramophone goods carried on by J. K. Gardner at 12, High Street, Cinderford, Glos, as Gardner Brothers. The permanent directors are: J. K. Gardner (managing director) and Mrs. M. Gardner, both of 12, High Street, Cinderford. Registered office: 12, High Street, Cinderford, Glos.

Associated Lighting, Ltd.—Private company. Registered March 31st. Capital, £500. Objects: To carry on the business of manufacturers of and dealers in lamps, discharge tubes, valves, vacuum tubes, &c. The subscribers are: W. J. Pattison, Spring View, Grimshaw Lane, W. Bollington, near Macclesfield, and J. R. Sinclair, 24a, Leam Terrace, Leamington Spa. W. J. Pattison signs as director. Solicitor: H. Bennett, Market Place, Macclesfield.

J. Jones Electrical Installations, Ltd.—Private company. Registered March 23rd. Capital, £1,000. Objects: To acquire the business of electrical and radio engineers now carried on by J. Jones. The directors are: J. Jones, 123, Walton Street, Oxford, C. J. Billingham, 70, Watling Street, Gillingham, Kent, and R. Jones, address not stated.

Darson Electrical Engineering Co., Ltd.—Private company. Registered March 29th. Capital, £100. Objects: To acquire the business of electrical engineers carried on by the Fairway Engineering Co., at 43b, Masons Avenue, Wealdstone. The directors are: L. O. Monson, 51, Tring Avenue, W.5, and two others. Secretary: H. F. D. Hammond. Registered office: 43b, Masons Avenue, Wealdstone.

Vernon White, Ltd.—Private company. Registered March 30th. Capital, £500. Objects: To carry on the business of importers, exporters and merchants of and dealers in radio, television and other instruments, &c. The directors are: A. H. Leadley and R. Leadley, 589, Anlaby Road, Hull, and W. P. Leadley, 8, Sandringham Street, Hull. Registered office: 589, Anlaby Road, Hull.

Walton & Gordon, Ltd.—Private company. Registered in Belfast March 21st. Capital, £4,000. Objects: To acquire the business of wholesale dealers in radio and electrical apparatus formerly carried on by Ensign, Ltd., at 38a, Queen Street, Belfast, and latterly by A. V. Froggatt as Waltons. The subscribers are: S. Walton, 10, Belgravia Avenue, Belfast; and M. B. Davison, 24, Arthur Street, Belfast. Registered office: 38a, Queen Street, Belfast.

Electric Keep-You-Fit Appliances, Ltd.—Private company. Registered March 25th. Capital, £1,000. Objects: To manufacture and sell electric "Keep-You-Fit" appliances and other apparatus, &c. The subscribers are: J. B. Duncan, 147, Queen Victoria Street, E.C.4; and S. E. Kerridge, 5, Colburn Avenue, Hatch End, Mdx. Secretary: S. E. Kerridge. Registered office: 147, Queen Victoria Street, E.C.4.

Ern Peabody, Ltd.—Private company. Registered March 25th. Capital, £2,000. Objects: To acquire the business of radio and electrical dealer carried on by E. Peabody at Three Gables, High Street, Staveley, and at Market Place, Bolsover, Derbyshire. The directors are: E. Peabody, 9, Netherthorpe Road, Staveley, Derbyshire (permanent director and chairman); and H. Illingworth, 78, Foljambe Avenue, Chesterfield. Secretary: H. Illingworth.

Fodor Lighting Co., Ltd.—Private company. Registered April 1st. Capital, £2,600. Objects: To acquire from J. Fodor the benefit of certain existing inventions relating to a system of lighting and to carry on the business of electrical engineers and contractors, &c. The subscribers are: J. Fodor, 60, Warminster Road, S.E.25, and Sir W. H. Webbe, Ash Pollard, Merstham, Surrey. J. Fodor is first and permanent director. Registered office: 8, Fredericks Place, Old Jewry, E.C.2.

Bestron, Ltd.—Private company. Registered April 1st. Capital, £100. Objects: To carry on the business of electricians, mechanical engineers, manufacturers of and dealers in electrical apparatus, &c. The directors are: J. W. Jones, 49, Melton Road, West Bridgford, Notts (director of Safety Twin Lamp Co., Ltd., and Bestron Lamp Co. (Nottingham), Ltd.), and L. C. Edwards, 63b, King's Road, Chelsea, S.W.3 (director of Safety Twin Lamp Co., Ltd.). Registered office: 36-38, Victoria Street, S.W.1.

Manchester Magneto Co. (Man-Mag), Ltd.—Private company. Registered April 1st. Capital, £1,000. Objects: To carry on the business of manufacturers and repairers of and wholesale and retail dealers in magnetos, dynamos, motors, armatures, batteries, &c. The first directors are: G. L. Fletcher (permanent managing director), 36, Ryebank Road, Firswood, Manchester, 16, and E. Offland, 56, Grosvenor Road, Sale, Ches. Registered office: 51, Hardman Street, Deansgate, Manchester.

Returns of Electrical Companies

Universal Electric Time & Telephone Systems, Ltd.—Mortgage on contracts for the installation and maintenance of electric clocks, dated March 23rd, 1938, to secure £750. Holder: Mrs. E. Stoddart, The Avenue, Portishead.

Rentals R.A.P., Ltd.—Satisfaction to the extent of £2,500 on March 18th, 1938, of debenture registered February 2nd, 1938.

Enfield Cable Works, Ltd.—The nominal capital has been increased by the addition of £400,000 in £1 ordinary shares beyond the registered capital of £800,000. 500,000 ordinary shares of £1 have been converted into ordinary stock.

R. H. Spence & Co., Ltd.—F. Pearson, of Finsbury Court, Finsbury Pavement, E.C., ceased to act as receiver on March 23rd, 1938.

G. S. Hawker, Ltd.—E. G. Bourne, of 6, Holborn Viaduct, E.C.1, ceased to act as receiver and/or manager on March 24th, 1938.

H. G. Cooper, Ltd.—Satisfaction to the extent of £600 on March 17th, 1938, of charge dated June 30th, 1925, and registered July 18th, 1925.

British Automatic Refrigerators (1936), Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated March 18th, 1938, to secure £10,000 and ranking *pari passu* with existing debentures. Holders: Branch Nominees, Ltd.

Watmough (Wakefield), Ltd.—Debenture charged on the company's undertaking and property, present and future, including uncalled capital, dated March 10th, 1938, to secure £2,000. Holder: Mrs. A. F. Watmough, 1, Hatfield Street, Wakefield.

Naider Bros. & Thompson, Ltd.—Capital, £30,000 in 15,000 preference and 15,000 ordinary shares of £1. Return dated December 9th, 1937. 14,968 preference and 14,849 ordinary shares taken up. £13,881 paid on 12,000 preference and 1,881 ordinary shares, £15,936 considered as paid on the remainder. Mortgages and charges, £6,450. A return of allotments, made up to February 28th, 1938, shows a further 32 preference and 151 ordinary shares allotted for cash and fully called up.

Whittaker Bros., Ltd.—Capital, £7,000 in 1,000 cumulative preference, 5,000 "A" ordinary and 1,000 "B" ordinary shares of £1. Return dated December 31st, 1937 (filed March 11th, 1938). 3,907 shares (class not stated) taken up. £3,207 paid, £700 considered as paid. Mortgages and charges nil.

City Notes

Associated Electrical Industries, Ltd., held its annual meeting on April 1st when Sir Felix Pole (chairman), who presided, said that two new reserves had been created. The special reserve of £100,000 had been made in connection with pensions. Each of their subsidiary companies had its own staff pension plan, but these did not provide adequately for the senior members of the staff. They had decided, therefore, to establish a pension fund for their group to provide for these senior members. They had also placed £100,000 to a dividend equalisation account. The output from the various works of the group was greater than in previous years. Orders received during 1937 as well as orders in hand at the end of the year showed a substantial increase over those for 1936 and constituted a record. The group now had 41,721 employés, twice as many as the lowest during the slump, and the value of orders received last year was more than double that for the year 1933. As regards the future, he would repeat what Mr. Lusk, their managing director, had said at the B.T.H. meeting, that although they did not think that the volume of business available in 1938 would equal that of 1937, they did not expect any serious recession, particularly as they started the year with a large unfulfilled order book. With regard to the business of the Metropolitan-Vickers Electrical Co., Ltd., they were co-operating with the Government in connection with the armaments programme. They had undertaken important munitions contracts and had also placed their research facilities at the disposal of the Government, but they had in no way prejudiced their capacity to execute home and export orders. The area and productive capacity of the Trafford Park works had been extended and most of the additional buildings required to cope with Government work and their increased order book were now occupied by productive processes, and deliveries from them would commence this year. Large orders received included one from the Victoria Falls and Transvaal Power Co. for four more 33,000-kW turbo-alternator sets for the Klip River power station. When these were installed the station would be the only one in the world equipped with twelve 33,000-kW sets of the same design and manufacture. They had received an order for another 100,000-kW turbo-alternator set for the London Power Co.'s Battersea station, also a large repeat order for switchgear for the same station. The South African Railways ordered forty-two locomotives similar to the 120 previously supplied by the Met.-Vick. Co. There were now approaching 400 miles of electrified main line. Another important railway order was for the L.N.E. Railway for the electrical equipment for seventy mixed traffic locomotives required for the Manchester-Sheffield electrification. The Sheffield works had benefited from a large influx of orders for trolley-bus equipment and they were also now manufacturing battery vehicles on a large scale. A considerable amount of business had been placed with them by the Central Electricity Board. Of apparatus in process of manufacture or completed during the year, a 7,000-h.p. mill motor constructed for Richard Thomas & Co.'s Ebbw Vale works was the largest d.c. mill motor built in this country. A second 40,000-kVA transformer was delivered to the Sheffield Corporation. Last year the Warsaw Junction electrification scheme was completed and officially inaugurated, and the first section of the electrification of the Central Brazil Railway was put into commercial service. The extensive signalling equipment forming part of the electrification scheme installed by the General Railway Signal Co. was manufactured at Trafford Park. They had had to increase their research laboratories, and extensions now in course of construction would considerably increase their accommodation. For some years past they had done a very large business in South Africa, including winders for mines, generating station equipment and railway electrification. During his visit to South Africa, however, he found that in an electrically minded community among whom the use of electrical domestic appliances was growing rapidly, and whose desire was to buy from England, the percentage of British appliances sold was very small. Appliances that were favoured here were said to be unattractive overseas, and there was no doubt that there were grounds for this criticism and that we needed carefully to review our designs of household electrical appliances.

British Insulated Cables, Ltd., held its annual meeting on April 1st, when Sir Alexander Roger (chairman), who presided, said that during the year under review new records had again been achieved, both in the value of sales and in the volume of output. These increases had been spread over practically all their products, which were now classified under about eighty different headings. Their wholly owned subsidiary, British Copper Refiners, dealt last year with over 50,000 tons of copper. Profits were not so good as in the previous year, but were satisfactory. With regard to the Brazilian and Polish railway electrification contracts, work on the former was nearing completion, and the Polish contract was completed some months ago. They had obtained contracts from L.N.E. Railway for the track equipment work for the electrification of the main line from Manchester to Sheffield, and for that part of the London system from Liverpool Street and Fenchurch Street to Shenfield. These contracts covered over 400 miles of single track, had a value of over £1,000,000, and constituted the most important railway work yet to be carried out in this country on the overhead system. They were obtaining their fair share of the work of their class arising out of the rearmament programme, but it amounted to only a small proportion of their aggregate business. The increase in output and the improvement achieved in certain manufacturing processes had, in spite of increased costs of materials and labour, enabled them to reduce still further the selling prices of many of their products. By advancement of technique they had during the past ten years reduced the cost of the manufacture of copper wire by over 50 per cent., and yet they were now earning less profit per ton of output than they then were. The chairman criticised the establishment of small works for the manufacture of electrical conductors. He said that in the year in which the profits of their company were a record, a large proportion was derived not from their trading but from earnings upon investments made out of reserves gradually accumulated over the past fifty years. The cable plant already existing in this country was amply sufficient to meet all requirements of the trade, and in the past few months the volume of business available showed distinct signs of recession. He thought it was folly, therefore, to start new cable-manufacturing undertakings which, instead of improving employment, had the reverse effect. Fortunately, they were in a position of great financial strength and it was their intention to maintain the quality of their products whatever might arise in the matter of competition. In view of the adverse factors mentioned he could not hold out such high hopes for 1938 as for 1937. Orders were not so plentiful as they were a year ago, although the works were busy, and particularly so on telephone cable orders for the British Post Office.

The Midland Electric Corporation for Power Distribution, Ltd.—Presiding at the annual meeting held on April 1st, Mr. G. H. Nisbett (chairman), said that capital assets in the distribution system had increased by £206,000. Since they began to operate under the 1933 Special Order £1,019,000 had been expended on capital extensions. During the year they spent £22,000 on installations on hire purchase, and since the inauguration of the scheme they had assisted consumers with the initial cost of installations and apparatus to the extent of £134,000, largely in respect of Council estates where gas was first provided. The results of the year's trading were satisfactory even though they had not made the full statutory profit permitted under the Order. They were unable to increase the 22½ per cent. discount which now operated on all rates in the standard tariff in their Order. Had costs not increased there would have been further reductions. Fuel costs had grown by over 30 per cent., and this year it was probable that they would be 50 per cent. above the cost of fuel on which the standard tariff was based. No addition had been made to the charges for electricity in respect of fuel increases, and this represented a substantial contribution to industry in a district which almost entirely depended for motive power on supply from the company's mains. The volume of sales continued to grow, but there was still a wide opportunity in this area for expansion, particularly for furnace work, in which direction the use of electricity showed marked advantages, especially in the matter of quality of product. Nearly two miles of additional cable per week had been laid and there was no sign of a falling off at present. Their load was increasing rapidly and it was now necessary to consider a new feeding point other than Ocker Hill. Plans were in hand and work would be proceeded with during the year. Their general supply was two-phase, but they had now made provision in their tariffs to give a three-phase supply to consumers of over 50 h.p. without any additional charge. There had been a marked development of the domestic load. Of the 22,000 kW of new connections, 8,000 kW was in respect of domestic supplies. It should be borne in mind that their area was almost entirely industrial, and did not lend itself to large domestic loads. Their head offices were moved last year from Birmingham to new premises at Tipton, near the centre of the company's area of supply.

The Automatic Telephone & Electric Co., Ltd., held its annual meeting on March 31st, when Sir Alexander Roger (chairman), who presided, said that the accounts under review were in respect of the first full year's working since they acquired the manufacturing and other business formerly carried on by the Automatic Electric Co., Ltd. The benefits derived were substantial and already justified the amalgamation of the two companies. With regard to Elexcel, Ltd., some years ago the Automatic Electric Co., Ltd., embarked on the manufacture of heating and cooking appliances. This sideline was incorporated as a separate company in 1936, and since that date a great amount of effort had been expended in developing the sales organisation and improving the production. The trade was unregulated and was subject to price competition, which was not good for the consumer or for progress in the industry. They had come to the conclusion, therefore, that they should limit their competition to products on which they would specialise for the immediate future. They believed that by this concentration there was a reasonable hope of making some profit. The expansion and development of the Post Office telephone system continued unabated. The industry had taken its part not only in technique and production but also in popularising the telephone through the medium of the Telephone Development Association, and one of the main problems which now existed was to make the advantages of telephone service available to those classes of the population with lower income levels. Since 1928 they had progressively reduced the price of their equipment to the Post Office by 28 per cent. The total value of their export orders constituted a record and covered sixty different countries overseas. They secured from the South African Government the order for the Pretoria area so that they now had been made responsible for the telephone system of the whole Rand. Telephone development in Australia had been proceeding apace, and they had received a satisfactory share of the orders. From New Zealand they had also received a proportion of acceptable business. They continued to supply equipment to Poland and Lithuania, and through the Telephone and General Trust they had received a considerable number of orders from the various islands in the British West Indies. Vehicle-actuated traffic signals continued to be supplied in good quantity and business in remote-control equipment continued to grow.

Ericsson Telephones, Ltd.—Presiding at the annual meeting on March 30th Col. Sir Harold A. Wernher (chairman) said that the factory had been fully employed throughout the past year. Approximately 4,000 people had been regularly employed, which was the same number as in the previous year, and the volume of work in hand and prospects ensured them full employment for some time to come. They were now reaping the benefits of the greater machine capacity and rearrangement of shops at the factory to which reference was made last year. Their business with countries within the British Commonwealth had been maintained, and at the moment they had in progress important contracts for automatic telephone exchanges for the Australian Post Office. Their various departments all benefited from the improved trading conditions which had prevailed throughout the year, and each contributed to the satisfactory trading results. They had acquired the sole rights for the British Empire for the manufacture of metal powders (aluminium and bronze), and a form of highly dispersed red lead powder. They had erected buildings on their spare land at Beeston and the plant was now being installed. From time to time additions had been made to their range of manufactures; nevertheless, the production of telephone and telephonic apparatus remained their principal activity. There were at present approximately three million telephones connected to the public system in this country, the increase for the year being 8.56 per cent. Last year 2,000 million effective calls were handled by the public system, but despite these figures the high-water mark of telephone development was not yet within sight; each tariff reduction and concession showed the potential demand to be still greater, and they as manufacturer fully recognised that their interests lay in the constant effort to cheapen apparatus by means of simplification of designs, research work and improved manufacturing methods. With regard to the outlook, for the first three months of the current year their sales were in excess of 1937 and they had a record volume of work in hand; furthermore, in the future they would reap the benefit of the increased capacity of the factory. Unfortunately, the political situation abroad was extremely confused and unsettled and they must all be conscious of the possibilities of difficulties ahead.

A. Reyrolle & Co., Ltd., report a profit for 1937, after providing for depreciation of buildings and plant and including interest received on investments and loans, of £155,322, as compared with £130,743 in the previous year, to which is added £128,336 brought in. After deducting £1,500 voted at the last annual meeting for distribution among local charitable and other funds, there is a balance available of £282,158. The dividend for the year on 585,000 ordinary shares is maintained at 12½ per cent. by the final payment of 7½ per cent., and a dividend of 7½ per cent. is paid on 195,000 new ordinary shares. The balance carried forward is £147,233. Expenditure on capital account during the year amounted to £188,837, covering extensions to buildings and plant, some of which were still in progress. Expenditure on the short-circuit testing station and testing equipment amounting to £35,759 was charged to development expenditure account, and £52,345 was written off the depreciation. The report states that there was an increase over the previous year in the value of orders received and in the sales of the company's products. A resolution will be submitted to the meeting on April 7th that an amount of £1,500 for the University of Durham, King's College, Building Fund and £1,500 for distribution among local charitable and other funds shall be set aside out of the profits for the year.

Kolster-Brandes, Ltd.—The International Telephone and Telegraph Corporation, which holds 76 per cent. of the company's shares, has offered to purchase the minority shareholders' holdings at 3s. 9d. per share (stated to be 6d. per share in excess of the book value). As an alternative the Corporation offers to sell its own holdings to the minority shareholders at 3s. 3d. per share. The Kolster-Brandes directors recommend the acceptance of the first offer, which will involve the formation of a new company to take over the remaining assets. An extraordinary meeting is to be held on May 2nd (after the annual general meeting), at which resolutions will be submitted for the voluntary winding-up of the company and the registration of a new company bearing the same title. The company states that any re-arrangement will not affect its trading in any way. For the year 1937 there was a loss of £52,828, bringing the total debit balance up to £160,585. During the year Mr. C. W. Eve was appointed to the board, Mr. P. F. Hart resigned as managing director but remains on the board. Mr. F. A. Cobb was appointed general manager, and Mr. L. C. Morrison resigned from the board.

The Watford Electric Manufacturing Co., Ltd., held its annual meeting on March 30th when Mr. J. L. Lawson, who presided, said that the value of orders received during 1937 was about 30 per cent. in excess of the figure for the preceding year, and while there were reports of some businesses experiencing a falling off in orders, the position of their company was the reverse, for the value of orders received this year to date was in excess of the corresponding period last year. The directors felt that the prospects for the present year were satisfactory, particularly as the extension of the works which was brought into use in August last was now materially assisting in expeditious production.

The Southern Areas Electric Corporation, Ltd., reports a net profit for 1937, after providing £20,952 for depreciation in the subsidiary companies' accounts, of £37,953 as compared with £26,502 in the preceding year, to which is added £7,458 brought forward. It is proposed to pay a final dividend of 3 per cent., making 5 per cent., less tax, for the year (against 4½ per cent. on smaller capital), and to carry forward £16,030. During the year the Corporation acquired the whole of the debentures and approximately 97 per cent. of the share capital of the Peacehaven Electric Light & Power Co., Ltd., and has taken up further shares in its subsidiaries, to enable them to finance their development expenditure. The kWh sold by the subsidiaries showed an increase of 18 per cent.

The Cambridge Electric Supply Co., Ltd., reports a net profit for 1937 of £39,873, which with £8,475 brought in makes £48,348. It is proposed to place £5,000 to general reserve, and to pay a final ordinary dividend of 4½ per cent., making 7 per cent. for the year. The balance carried forward is £8,348.

Heatrae, Ltd., reports a net profit for the year ended February 28th of £12,506, to which is added £1,664 brought in, making £14,170. A dividend of 12 per cent., less tax, is paid on the ordinary shares for the year, £3,403 is appropriated to writing down goodwill account to £12,000, a sum of £250 is contributed to employés' endowment policies, and £3,016 is carried forward. Meeting: April 12th at Norwich.

The Rangoon Electric Tramway and Supply Co., Ltd., reports a net profit for 1937 of £70,515, as against £59,090 for 1936. The final ordinary dividend is 7½ per cent., making 10 per cent. for the year (against 8½ per cent.), and £18,311 is carried forward (£17,797 brought in). The company's vehicles travelled 7,413,692 miles and carried 46,875,550 passengers. Application for permission to operate trolley-buses in place of the existing tramways and for additional routes has been made to the authorities. The reduction in rates for electricity has led to an increase in the kWh sold in 1937, other than street lighting and traction, by 7.5 per cent.

The Anglo-Portuguese Telephone Co., Ltd., reports a net profit for 1937 of £78,013, as compared with £89,087 for the preceding year, to which is added £26,285 brought in and £733 tax adjustment. The final dividend on the ordinary stock is 5 per cent., making 8 per cent. for the year, and the dividend for the year on the "A" ordinary shares is 8 per cent. (same). The balance carried forward is £27,069. The dividend on the ordinary stock is paid on larger capital. The report states that the growth of the system continues on a satisfactory basis, and during the year 3,021 stations were added. In accordance with the contracts entered into with the Government on July 3rd, 1936, a message-rate method of charging for service became general throughout the company's system on July 1st, 1937. This has temporarily disturbed the incidence of collection of revenue, and the results of the new tariff can only be realised after a full year's operation.

G. D. Peters & Co., Ltd., report a net profit for 1937 of £38,295,as compared with £21,912 in the preceding year. The capital reorganisation scheme became effective at the end of July last year, and the directors recommend a dividend at the rate of 15 per cent. per annum in respect of the five months ended December 31st, leaving £4,392 to be carried forward. The directors have decided to issue the 100,000 ordinary shares of 5s. sanctioned in April, 1937. These are to be offered to shareholders in proportion to their holdings.

The Telegraph Condenser Co., Ltd., reports a profit of £21,773 for 1937, as compared with £22,556 for 1936. It is proposed to pay an ordinary dividend of 5 per cent. (against 10 per cent.), and to set aside £8.697 for taxation, leaving £8,989 to be carried forward (against £7,388 brought in).

The Hankow Light & Power Co., Ltd., is paying an interim ordinary dividend of 8 per cent.

Stocks and Shares

TUESDAY EVENING.

IT can be said that conditions in the Stock Exchange markets are more cheerful than they have been of late, the change in sentiment being due, in no small measure, to the recovery that has occurred in prices of American stocks and shares. This recovery is apparently not to be entirely trusted as indicative of a sustained improvement in trade; that is, if the opinions of various American writers are to be accepted as authoritative. As it has been so often said before, America is the principal consumer of various raw materials, base metals, &c., and conditions which obtain in the United States are therefore bound to play a large part in determining values in other quarters. This factor it is which causes American politics to be thrust into so many financial matters that might seem far removed from the bounds of American affairs.

The easing of the position as it relates to American issues, has its repercussion in such shares as those of the electrical industry and of the manufacturing and equipment companies. The general tendency this week is towards better prices. With this improved disposition there has come an increase in business activity. Hopes of an Anglo-Italian agreement and of an early cessation of hostilities in Spain are correctives to the seasonal influences of holiday and Budget approaches.

Industrial Yields Now

At this time last year it was no easy matter to find first-class industrial ordinary shares to earn 4 per cent. Now, after the lengthy decline rounded off by last month's sharp drop in prices, the investor can take his choice from a lengthy list of good industrials giving returns upwards of 5½ per cent. Still higher yields can be obtained from many shares of good standing. Politics, of course, have taken a prominent position in accelerating the fall of prices. Another reason for this change of ideas as to what constitutes a proper yield under present circumstances was put in a nutshell at the annual meeting of Associated Electrical Industries. The chairman said frankly that the year 1937 is now regarded as a peak year, and, although no serious set-back is feared, it is not expected that the volume of business this year will equal that of 1937. In the category of electrical equipment shares giving yields in the neighbourhood of 5½ per cent., are Associated Electrical Industries, Siemens, Telegraph Constructions, Johnson and Phillips and Revo Electrics.

Six Per Cent. Upwards

As our share list shows, yields of 8 per cent. or more are available from shares such as Lancashire Dynamo, Ever Ready

and Aron Meters. Other issues which pay 6 per cent. upwards on the money are these:—

Ordinary Shares.	Price.	Dividend %.	Yield %. £ s. d.
Electrical Switchgear (10/–)	25/6	16	6 5 6
Allen West (5/–)	5/9	7½	6 10 5
Switchgear & Cowans (5/–)	15/–	20	6 13 4
Westinghouse Brake	50/–	17½	7 0 0
Crabtree Electrical (10/–)	25/–	17½	7 0 0
Walsall Conduits (4/–)	24/–	55	9 3 3
Strand Electric (5/–)	5/–	10	10 0 0

Price Movements

During the past week the industrial markets have passed through a shaky spell, from which they appear to have emerged on to firmer ground. On balance, prices are not changed to any great extent. The electrical equipment list would have a steady appearance, but for another bout of weakness in the cable manufacturing group. The fall in Enfield Cables has been extended to 2$\frac{7}{16}$, as compared with 2$\frac{1}{2}$, ex bonus, a week ago. British Insulated gave way half a crown, to 4$\frac{1}{4}$, after the meeting. Callenders at 4$\frac{1}{16}$, Henleys at 17s., and Johnson and Phillips at 35s., are all lower. Associated Electrical Industries recovered to 36s. after dipping to 35s. 6d. Gains of 1s. or more are shown by General Electrics at 70s. 6d., Crompton Parkinsons at 23s. 9d., and Automatic Telephones, which rose to 38s. on further consideration of the year's results. Lancashire Dynamos fell $\frac{1}{8}$ to 2$\frac{3}{4}$. Electricity supply ordinary shares present few price changes of any consequence.

Preference Shares

Prices of industrial preference shares were not left altogether unscathed by last month's disturbing events. Previously, the shares as a class—and those of electricity supply companies in particular—had been a little unsettled by the position of Oxford Electric preference shareholders during the negotiations for the purchase of that company. As a result, many shares are now on offer at prices a shilling or two below the year's top levels. Shares which to-day stand noticeably cheaper in the electricity supply group are the six per cent. preference issues of British Power and Light, offered at 26s. 6d., and of Edmundson's Corporation, at 25s. 6d., the respective yields being 4$\frac{1}{2}$ and 4$\frac{3}{4}$ per cent. On Scottish Power and Midland Counties "sixes" the yield is £4 7s. per cent. The 7 per cent. issues of North Eastern and Midland Electric pay nearly 4$\frac{1}{2}$ per cent. Public interest in the accounts, just published, of the "Three Counties" Power Company is limited to the 6 per cent. preference shares, practically all the ordinary being in the hands of Edmundson's. The former are offered at 27s. 3d., to yield £4 8s. per cent. on the money. Investment is inclined to fight shy of shares quoted at what look to be high premiums above the nominal value.

Cable and Wireless

Cable and Wireless stocks have been moderately active during the past few business days, on account of reported proposals which, if carried into effect, might possibly improve the status of the combine's securities. The price of the ordinary stock rose to 61 before easing off to the previous level of 59. The published anticipations may be thought to cancel out one another, as the children at school say about their sums. The real ground for expecting a change for the better in the fortunes of Cable and Wireless lies in the hope that the Dominions and Colonies which at present run high-power stations of their own, may consent to do away with these and to leave the whole business in the hands of Cable and Wireless.

If this should take effect, as is claimed to be at least possible by those who profess to have behind-the-scenes information, then Cable and Wireless stocks may be deemed reasonably priced. The dividend on the ordinary stock, to be declared at the end of this month, is expected to be 4 per cent. With a yield of 6$\frac{3}{4}$ per cent. on the money to give this stock claim to the investor's consideration, the scope for capital appreciation is tolerably clear. It remains to be seen, however, how far these expectations will be realised. If they do not materialise, it must be confessed that the traffic returns of the past few months do not at present give the ordinary stock any higher status than that of a speculative investment whose prospects depend mainly upon international trade.

American Markets

At the moment, prices of American stocks are staging a rally after another precipitous fall. Reports of industrial conditions in the United States provide no solid foundation for a sustained recovery: consequently, few people are confident enough to expect the present movement to prove more than a technical reaction. Such optimism as survives in Wall Street is relying on the very severity of the set-back in business to force the hand of the Administration into relaxing its pressure on private enterprise and capital. As representative of the extent to which prices have fallen from last year's best levels, it can be noted that General Electric stock has come down from 65 to 31, and Westinghouse Electric from 167 to 67. In the case of stocks of lower standing, the collapse has often been a great deal steeper. Communication stocks were unsettled this week by the Federal Communication Commissioners' report, which fulfilled market apprehensions. American "Tel. and Tel." sank to 112$\frac{1}{2}$, a drop of 17 points in two weeks, before recovering to 117$\frac{1}{2}$.

Share List of Electrical Companies

	Nom.	Previous.	Last.	Price April 5.	Rise or Fall.	Yield p.c. £ s. d.
Home Electricity Companies.						
Bournemouth and Poole	1	15	15	63/9	—	4 14 4
City of London	1	7⅛	7⅛	33/6	—	4 9 7
Clyde Valley	1	7	8	39/–	—	4 2 3
County of London...	1	10½	10½	48/–	–6d.	4 7 7
Edmundson's 7% Pref.	1	7	7	32/–	—	4 6 2
Do. Ord.	1	8	9	36/–	—	5 0 0
Elec. Dis. Yorkshire	1	9	9	39/–	—	4 12 4
Elec. Fin. and Securities	1	12½	12½	48/9	—	5 2 6
Elec. Supply Corporation ...	1	11	12	51/3	—	4 13 8
Lancs Light and Power	1	7⅛	7⅛	32/6	—	4 12 4
Lond. Assoc. Electric	1	—	7	30/–	—	4 13 4
London Electric	1	8	7	35/6	—	3 19 0
London Power Deb. Red. ...	Stock	5	5	104½	—	4 15 8
Metropolitan	1	10	12	47/–	—	5 2 2
Midland Counties	1	7⅛	8	35/6	—	4 10 0
Mid. Elec. Power	1	8	9	38/9xd.	+1/–	4 13 0
North Eastern Electric Ordinary	1	6	7	28/6	—	4 13 4
Do. 7% Pref.	1	7	7	31/6	–1/–	4 9 0
Northampton	1	10	10	46/3	—	4 6 7
Notting Hill 6% Pref.	10	6	6	14	—	4 5 9
North Met. Elec. Ordinary ...	1	10	10	46/3	—	4 6 6
Do. do. 6% Pref. ...	1	6	6	29/–xd.	—	4 2 9
Scottish Power	1	8	8	35/6	+6d.	4 10 2
South London	1	7	7	32/–	—	4 7 6
Whitehall Elec. Invst. 7½% Pref.	1	7⅛	7⅛	18/9	—	8 0 0
Yorkshire Elec.	1	8	8	38/–	—	4 4 4
Public Boards.						
Central Electricity, 1950–70 ...	Stock	5	5	110½	—	4 13 6
Do. 1955–75 ...	„	5	5	114½	—	4 7 2
Do. 1951–73 ...	„	4½	4½	108½	—	4 3 0
Do. 1963–93 ...	„	—	3½	98½	—	3 11 0
London Elec. Trans. Gtd. ...	„	—	2½	92	—	2 14 4
London & Home Counties, 1955–75	„	4½	4½	112	—	4 0 4
London Passenger Transport, A...	„	—	4½	117½	—	3 16 6
Do. do. B...	„	—	5	120½	—	4 3 0
Do. do. C...		4	4⅝	79½	—	5 7 0
West Midlands Joint Elec. 1948–68		—	5	111	—	4 10 1
Telegraph and Telephone.						
American Tel. & Tel.	$160	9	9	117½	—	7 13 3
Anglo-Am. Tel. Pref.	Stock	6	6	106½	–1	5 12 7
Do. Def.	„	1½	1½	26½	—	5 13 2
Cable & Wireless 5½% Pref. ...	„	4½	5½	27	–1½	5 13 5
Do. Ord.	„	—	—	59½	—	—
Do. Income	„	—	—	101½	—	3 18 10
Globe Tel. & Tel. Ord.	10	4½*	5½*	13½	—	4 3 0
Do. do. Pref.	10	6	6	13	—	4 12 4
Great Northern Tel.	10	20	20	37	–1½	5 8 0
Marconi-Marine	1	10	7⅛	26/3xd.	—	5 14 1
Oriental Telephone Ord.	1	12*	12*	2⅛	—	4 9 3
Home and Foreign Trams, etc.						
Anglo-Arg. Trams First Pref. ...	5	Nil	Nil	3/9	–1/8	—
Do. do. 2nd Pref.	5	Nil	Nil	3/9	—	—
Do. do. 5% Deb.	Stock	Nil	Nil	10	—	—
British Electric Traction Def. Ord.	„	5	5	850	–25	—
Do. do. Pref. Ord.	„	8	8	155	—	5 3 3
Brazil Traction	$100	70 cts.	$1	8½	–¼	—
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	99½	—	5 0 6
Mexican Light Common	$100	Nil	Nil	1	—	—
Do. 1st Bonds...	$500	5	5	25	—	—
Victoria Falls Ord.	1	20	12	57/–	–6d.	4 4 5
West Riding	1	6½	10	37/6	—	5 6 8
Manufacturing Companies.						
Aron Electricity Ord.	1	15	15	1⅝	—	8 0 0
Assoc. Elec. Ord.	1	10	10	36/–	—	5 11 3
Do. Pref.	1	8	8	38/–	—	4 4 6
Babcock & Wilcox	1	8	10	39/6	–1/8	5 1 3
British Aluminium Ord.	1	10	12½	49/6	+2/–	5 1 0
British Insulated Ord.	Stock	20	20	4¼	–¼	4 17 1
Brush Ord.	Stock	Nil	Nil	16½	—	—
Callender's...	1	15	15	4 1/16	–1/8	3 13 9
Do. 6½% Pref.	1	6½	6½	31/3	—	4 2 4
Crompton Parkinson Ord. ...	5/–	12½	12½	23/9	+1/8	—
Do. 8% Pref.	1	8	8	37/6	—	4 5 4
Electric Construction	1	7	10	32/6	—	6 3 1
Enfield Cable Ord.	1	25	25	2 7/16	–1/8	—
English Electric	1	Nil	10	27/6	—	7 5 6
Do. do. Pref.	1	6½	6½	25/–	—	5 4 0
Ericsson Tel.	5/–	25	25*	1⅛	—	3 14 1
Ever Ready	5/–	35	45	24/–	–6d.	9 7 6
Ferranti Pref.	1	7	7	25/–	—	5 12 0
G.E.C. Pref.	1	6½	6½	32/6	—	4 0 0
Do. Ord.	1	15	17½	70/6	+1/–	4 19 5
Henley's	5/–	30	15	17/–	–6d.	4 8 3
Do. 4½% Pref.	1	4½	4½	1½	—	4 0 0
India-Rubber Pref.	1	5½	5½	21/3	—	5 3 6
Johnson & Phillips	1	¼	10	35/–	–1/8	5 14 1
Lancashire Dynamo	1	20	25	2¾	–¼	9 4 0
Siemens Ord.	1	6	7½	26/3	—	5 14 1
Telegraph Construction	£1	7½	10	37/6	—	5 6 8

* Dividends are paid free of Income Tax.

Published Specifications

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all further proceedings will be taken.

1935

22638. "Thermally actuated electric switch and like control apparatus and means for varying the operating time period." A. G. Bullen. September 11th, 1935. (481424.)

34120. "Dry cells and batteries." H. Prince and M. MacCallum (legal representatives of F. MacCallum, decd.) and A. H. Redfern. June 9th, 1936. (481196.)

1936

15085. "Electric furnaces." Norton Grinding Wheel Co., Ltd. June 6th, 1935. (481229.)

18720. "Cathode-ray tubes." Radioakt.-Ges. D. S. Loewe. July 6th, 1935. (481430.)

18940. "Metal envelope electron tube." Egyesult Izzolampa es Villa-Mossagi Reszenvenytarsasag. July 8th, 1935. (481282.)

22081. "Self-starting synchronous motors." E. Barraclough and P. A. H. Mossay. August 11th, 1936. (481504.)

23866. "Mercury or other conducting liquid switches." A. Cianachi. August 31st, 1936. (481289.)

24510. "Electrolytic condensers." Dubilier Condenser Co. (1925), Ltd. December 31st, 1935. (481292.)

24609. "Panels for electrical apparatus." British Thomson-Houston Co., Ltd., and G. W. Tapping. September 9th, 1936. (481365.)

24621. "Electrical heating elements." General Electric Co., Ltd., and O. W. Humphreys. September 9th, 1936. (481197.)

24640. "Electric communication cables." Allgemeine Elektricitäts-Ges. September 9th, 1935. (481510.)

24680. "Relaxation oscillators for television receivers." Radioakt.-Ges. D. S. Loewe. September 11th, 1935. (481444.)

24681. "Braun tube." Radioakt.-Ges. D. S. Loewe. September 25th, 1935. (481445.)

24722. "Electric generators." C. C. Roe. November 16th, 1935. (481200.)

24724. "Telephone systems." Automatic Electrical Co., Ltd. (in liquidation), and G. T. Baker. September 10th, 1936. (481447.)

24725. "Electrical signalling systems." Automatic Electric Co., Ltd. (in liquidation), and W. J. Brown. September 10th, 1936. (481448.)

24740. "Production and use of secondary electron emissive substances." H. G. Lubszynski. September 10th, 1936. (481563.)

24767. "Apparatus for electrically ascertaining an elapse of time adapted for indicating the time taken for relays to operate or release." Siemens Bros. & Co., Ltd., and E. H. Riber. September 11th, 1936. (481370.)

24809. "Magnetic deflecting means for electron-discharge devices." Baird Television, Ltd., and A. H. Gilbert. September 11th, 1936. (481516.)

24811. "Electric distant-control systems." Standard Telephones & Cables, Ltd., and A. C. Beck. September 11th, 1936. (481517.)

24813. "Apparatus for measuring electric potentials." Standard Telephones & Cables, Ltd., and B. B. Jacobsen. September 11th, 1936. (481518.)

24940. "Radio receiving systems." E. H. Armstrong. September 14th, 1935. (481526.)

24941. "Multiplex radio signalling systems." E. H. Armstrong. September 14th, 1935. (481527.)

25051. "Indicating boards for use in remote supervisory or like systems." Automatic Electric Co., Ltd. (in liquidation), and G. A. Burns. September 14th, 1936. (481535.)

25366. "Fluxes and flux-coated electrodes for electric welding or the like." T. C. R. Shepherd and Metropolitan-Vickers Electrical Co., Ltd. September 17th, 1936. (481374.)

25816. "Thermostatically operated electric switches." Diamond H Switches, Ltd., and C. A. Turner. September 23rd, 1936. (481296.)

26447. "Cartridge fuses." Electric Transmission, Ltd., and K. Dannenberg. September 29th, 1936. (481299.)

29447. "Construction of electrically propelled vehicles." English Electric Co., Ltd., and S. A. Smith. October 29th, 1936. (481453.)

31392. "Electric contacts of the plug-and-socket type especially applicable to switches and fuses." J. E. Allan. November 17th, 1936. (481211.)

31547. "Electrical systems of control." General Electric Co., Ltd., and H. E. Bartlett. November 18th, 1936. (481213.)

32494. "Electric plug-and-socket connections." H. N. Baker and C. W. Parsons. November 27th, 1936. (481215.)

32695. "Selectivity control of high-frequency tuning circuits." E. K. Cole, Ltd., A. W. Martin and H. Hunt. November 30th, 1936. (481310.)

34434. "Radio receiving systems." G. W. Johnson (Philco Radio & Television Corpn.). December 15th, 1936. (481221.)

35495. "Electrical systems of control for electric consuming devices." General Electric Co., Ltd., and J. E. Collyer. December 28th, 1936. (481223.)

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247. "Liquid-insulated high-potential electric condensers." Siemens-Schuckertwerke Akt.-Ges. January 3rd, 1936. (481318.)

255. "Arc rectifiers." F. H. Hellmuth. January 4th, 1936. (481225.)

371. "High-frequency conductors and coils." E. Friedlaender. January 8th, 1936. (481319.)

412. "Discharge tubes or other electrical sources of radiation of light." Aktiebolaget Elektrod. January 9th, 1936. (481320.)

3357. "Electric bells or the like." General Electric Co., Ltd., and A. Warrington. February 4th, 1937. (481542.)

3639. "Manufacture of filaments for electric incandescent lamps." Vereinigte Glühlampen und Elektrizitäts Akt.-Ges. March 3rd, 1936. (481227.)

4026. "Piezzo-electric apparatus." H. Ando. February 27th, 1936. (481543.)

5639. "Electric fuse fittings." V. Hope. February 25th, 1937. (Addition to 480690.) (481544.)

7187. "Electron-discharge oscillation generator." British Thomson-Houston Co., Ltd. March 11th, 1936. (481330.)

7224. "Protection of transformer windings from over-voltages." Siemens-Schuckertwerke Akt.-Ges. March 11th, 1936. (Cognate application 7225/37.) (481233.)

10070. "Electrical heating apparatus of the storage type." A. Mouton and A. Huet. April 8th, 1936. (481335.)

10914. "Cathode-ray discharge devices." Standard Telephones & Cables, Ltd. August 20th, 1936. (481549.)

13013. "Radio and like transmitters and circuits and devices suitable for use therein." Marconi's Wireless Telegraph Co., Ltd. May 6th, 1936. (481343.)

13974. "Receivers for telemetering systems." British Thomson-Houston Co., Ltd. May 20th, 1936. (481345.)

15799. "Radio aerials more particularly for use on motor vehicles." K. T. Hardman. June 8th, 1937. (481242.)

16016. "Electric lamp holders and like coupling-sockets." British Thomson-Houston Co., Ltd. June 9th, 1936. (481349.)

16280. "Telephone receivers." Standard Telephones & Cables, Ltd. August 1st, 1936. (481351.)

16296. "Manufacture of electric heating elements." Soc. d'Etudes et d'Applications Industrielles. June 12th, 1936. (481243.)

17047. "Arc-extinguishing chambers for electric switches or circuit-breakers." British Thomson-Houston Co., Ltd. June 20th, 1936. (481246.)

18162. "Microphones." Marconi's Wireless Telegraph Co., Ltd. June 30th, 1936. (481551.)

19111. "Magnetic cores of inductive devices." Standard Telephones & Cables, Ltd. November 13th, 1936. (481249.)

19786. "Electron-discharge tubes." Telefunken Ges für Drahtlose Telegraphie. July 16th, 1936. (481251.)

20128. "Devices for igniting mercury cathode discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 23rd, 1936. (481253.)

20432. "Magnetic amplifiers." Standard Telephones & Cables, Ltd. August 20th, 1936. (481255.)

20631. "Mercury cathode discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. July 28th, 1936. (481256.)

20654. "Measurement of the amplitude of high-frequency alternating-currents." Telefunken Ges für Drahtlose Telegraphie. July 24th, 1936. (481405.)

21350. "Electric switches having automatic overload tripping or release mechanism." Siemens-Schuckertwerke Akt.-Ges. August 3rd, 1936. (481407.)

21734. "Electric cables." British Thomson-Houston Co., Ltd. August 6th, 1936. (481408.)

22218. "Electric-discharge tubes." C. Lorenz Akt. Ges. August 17th, 1936. (481409.)

23177. "Television." E. Michaelis. August 28th, 1936. (481264.)

23239. "Metal-vapour discharge tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. August 26th, 1936. (481265.)

23735. "Mercury or other conducting liquid switches." A. Cianchi. August 31st, 1936. (Divided out of 481289.) (481353.)

28356. "Rotating electrical liquid switch." J. M. Eerhard, C.Eerhard and C. A. Aandewiel (trading as Eerhard-Aandewiel. October 17th, 1936. (481416.)

28633. "Cathode-ray tubes." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. October 23rd, 1936. (Addition to 472240.) (481556.)

30724. "Float arrangements for supervising oil-filled electric apparatus." Siemens-Schuckertwerke Akt.-Ges. November 13th, 1936. (481418.)

31642. "Electric arc lamps." Korting & Mathiesen Akt.-Ges. December 24th, 1936. (481420.)

Trade Mark Applications

The following are among the latest applications for British trade marks. Objections against any of the proposed marks may be entered within one month from March 30th.

Gold Seal Electrolyte (lettering and design). No. 583,204. Class 1. Electrolyte.—Gold Seal Electrolyte, Ltd., 39, Victoria Street, Westminster, S.W.1.

Voltapex. No. 580,892. Class 8. Electrical condensers.—A. H. Hunt, Ltd., Bendon Valley, Garratt Lane, Wandsworth, S.W.18.

Munit. No. 582,043. Class 8. Instruments for measuring and recording electrical quantities.—Muirhead & Co., Ltd., Croydon Road, Elmers End, Beckenham, Kent.

Hexatype. No. 583,976. Class 13. Electric lamps (ordinary), &c.—W. T. George & Co., Ltd., 121-127, Bishop Street, Birmingham.

An E.P.E.A. Dinner

There was a large attendance at the 18th annual dinner of the London Western Section of the Electrical Power Engineers' Association, held last Saturday at St. Ermin's Hotel, Westminster. The chairman, Mr. J. D. Midforth, having given the loyal toast, Mr. J. Chuter Ede, M.P., proposed "The Association." He made a reference to the Electricity Bill, and said that whether it came into force or not, nationalisation would continue to take place with consequent greater production from fewer concerns. Unhappily, the gifts of modern science had not been utilised to employ all the people for fewer hours, and thus every amalgamation and mechanisation entailed more unemployment. He emphasised the need for a strong association, such as the E.P.E.A., to watch over those who had, in practice, invested their lives in an industry. The response was made by Mr. G. Gunn (vice-president of the Association), of Edinburgh, who said that the Association was now 6,000 strong and contained most of the supply engineers in the country. Claims due to the operation of the grid were being examined and resumption of the schedule revisions would begin in August. "Our Section and Our Chairman" was proposed by Mr. A. G. McLauchlan, response being made by Mr. J. D. Midforth. The speeches were interspersed with an excellent entertainment arranged by Mr. Cornet.

New Work for Contractors

Particulars of new works and building schemes for the use of electrical installation contractors and traders

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Aston.—Extensions to works, for Lingards Clothing Co., Ltd., Witton Road; T. Elvins & Sons, Ltd., contractors, Naden works, Soho Hill, Birmingham.

Axminster.—Houses (14), North Street; F. S. Kett, architect, West Street.

Barking.—Houses (47), Westrow Drive; Leftley Bros., Ltd. Houses (276) and six shops, Scrattons Farm estate (£121,180); borough architect.

Bedlington.—Houses (64), for the U.D.C.; G. Towers, builder, Blyth.

Berwick-on-Tweed.—Extensions and alterations to the Blenheim Hotel, Spittal; Peter Whitlie and Son, contractors, The Meadows estate, Berwick.

Bilston.—Factory, Moxley Road; for British Lock Washers, Ltd.

Birmingham.—Factory and offices, Lionel Street, for W. G. Proverbs, Ltd.; T. Elvins & Son, builders, Naden Street. Two pavilions, Marston Green Homes (£16,462); city engineer. School, Aldridge Road, Perry Barr (£77,500), for the E.C.

Bridgwater.—Carpet factory, Bristol Road, for Brintons, Ltd., Kidderminster; H. W. Pollard & Sons, contractors, Monmouth Road, Bridgwater.

Burton-on-Trent.—Houses (199), Rosliston Road housing estate; borough surveyor, Town Hall.

Carshalton.—Houses (63), Kingswood estate, Clavers Lane; Wates, Ltd., London Road, Norbury.

Chatham.—Houses (48), Pagitt Street and Perry Street; borough surveyor, Town Hall.

Cheadle.—Houses (40), Kingsley and Oakamoor; R.D.C. surveyor.

Chelmsford.—Houses (24), Second and Third Avenues; H. J. Jackson & Co.

Cheltenham.—Houses (52), Brooklyn Road; Western Estates, Ltd. Houses (15), Hales Road; G. A. M. Hall, Ltd. Houses (32), Swindon Road; Elmfield Park Estate Co., Ltd. Factory, for Will R. Rose, Ltd., Fairview Road; Potts Martyn & Co. Maternity home (£25,000); District Nursing Association.

Chester-le-Street.—Additions to Chester-le-Street secondary school (£30,000); Wigham and Son, builders, Castletown.

Dronfield.—Houses (56), Cross Lane and Fanshaw Road; U.D.C. surveyor.

Dudley.—Premises for Co-operative Society; Webb & Gray, architects, 200, High Street.

Durham.—Gymnasium for the girls' county school (£10,000); Berriman and Son, builders, Fence Houses.

Easington.—Houses (88); J .W. Hays, architect.

Eastbourne.—High School for Girls (£60,160), for the E.C.

Eastwood (NOTTINGHAM).—Cinema, Derby Road, for Rex Cinemas, Ltd.; A. G. Wheeler & Co., architects, Langley Mill.

Ebbw Vale (MONMOUTHSHIRE).—Houses (52), Canning Street; surveyor, Town Hall.

Enfield.—Houses (18), Lindon Crescent; J. H. Mason.

Eton.—Houses, Gerrard's Cross, George Green and Farnham Royal (£21,145); R.D.C. surveyor.

Finchley.—Clinic, Oak Lane (£13,944); Hansard, Ltd., 95, Great Portland Street, W.1.

Gainsborough.—Houses (47); R.D.C. surveyor.

Gantshill Cross (ESSEX).—Cinema, restaurant and ballroom, Clarence Avenue; H. Weston, architect, 31, Chester Square, London, S.W.1.

Glasgow.—School, Albert site; T. H. Hughes, architect. School, Whitehill; Denny & Blain, architects. Extensions to Maryhill Hospital (£191,500) and Stobhill Hospital (£191,500), for Corporation; city engineer.

Gosforth (NORTHUMBERLAND).—Block of flats with underground shelter, Great North Road; Cussins (Contractors), Ltd., Grange Park estate, Gosforth.

Grangetown.—Cinema at the junction of Redcar Trunk Road and Bolchow Road; P. Lanny.

Guildford.—Factory, Walnut Tree Close; H. Ashenden.

Halifax.—Houses (1,217); borough engineer.

Heanor.—Cinema, Derby Road, for Midlands Empire Theatres, Ltd.; A. J. Thraves, architect, Nottingham.

Hertfordshire.—Court House, Hatfield (£22,817), for C.C.; Ringmer Building Works, Ltd., Ringmer, Sussex.

Horwich.—Houses (106) and bungalows, Old Lord estate; T. Green, U.D.C. surveyor, Public Hall, Horwich.

Hyde.—Houses (120), Walker Lane site; borough surveyor, Municipal Buildings, Greenfield Street.

Inverness.—Factory, Telford Street, for Calindus Food Products, Ltd., 105, Hanover Street, Edinburgh.

Jarrow.—Municipal hostel, Primrose; J. S. Weir, borough engineer, Town Hall, Jarrow.

Kidderminster.—School, Habberley Lane (£69,837), for T.C.; A. H. Guest, Ltd., builders, Stourbridge.

Kingsclere (NEWBURY).—Houses (34), Overton, Whitchurch and Tadley; clerk to R.D.C., Council Offices.

Leeds.—Extension to Thorp Arch Grange school, for E.C.

Liverpool.—Dwellings (2,158) and shops, Council estates (£970,414); borough architect. School, Norris Green (£38,689), for the E.C.

Llanelly.—Extensions to depot for Llanelly and District Electric Supply Co., Ltd.; W. Griffiths & Sons, architects, Falcon Chambers.

Malden.—Cinema, café, &c., Malden Road, for Gaumont Super Cinemas, Ltd.; H. Weston, architect, 31, Chester Square, London, S.W.1.

Manchester.—Hotel, London Road; Anns & Haigh, architects, 58, Grosvenor Street, London, W.1.

Manfield (DARLINGTON).—Ward block, Manfield Orthopædic Hospital (£12,000), for Board of Management.

Mansfield.—Houses (16), Radmanthwaite Road; Radford & Jenkins.

Maryport.—Factory for West Cumberland Industrial Development Co.; Border Engineering Contractors, Ltd.

Middlesex.—Schools, Hatton Road, East Bedford, and Pinkwell Lane, Hayes, for the County E.C.

Milngavie.—Bank premises for Commercial Bank of Scotland, Ltd.; M'Callum & Gordon, George Street, Edinburgh.

Morecambe.—Houses (24), Heysham Hall estate; H. E. Shackleton.

Morpeth.—Houses (100), Stobhill Gate (£33,490), for T.C.; R. Carse & Son, Ltd., builders.

Mytholmroyd.—School (£76,000) for the Hebden Bridge E.C.

Nantwich.—Houses (13), Shrewbridge Road; L. Clark.

Narberth.—Houses (30), Ryeland's Lane, Kilgetty; J. Owen Parry & Lewis, architects, Ammanford.

Newcastle-on-Tyne.—Flats (140), Bentinck Road, for Council; Kirk & Dickinson, builders, New Bridge Street.

Northampton.—Houses (13), Malcolm Drive; Chowns, Ltd. Houses (32) and 4 shops, Windsor Crescent; A. & F. Gale, Ltd.

North Shields.—Three-storey building, for Montague Burton, Ltd., Hudson Road mills, Leeds.

Oban.—Extension to Royal Hotel (£15,000); Clark & Donaldson, 23, Princes Street, Aberdeen.

Oldham.—Houses (60), Higher Grasscroft, Saddleworth; A. Pellowe & Sons, builders, Chamber Road. School (£80,000), for the E.C.; J. W. Hitching, schools architect, Education Offices, Oldham.

Prescot.—Houses, Pottery Lane, Whiston; C. H. Reakes, builder, 138, Dragon Lane, Whiston.

Rochdale.—Houses, Clover Hall estate, Bellfield and Channing Street estate, near Crawford Street; S. H. Morgan, borough surveyor, Town Hall.

Romford.—Factory for the Merton Bone Co., Stratford.

Rothbury.—Houses (30), for the R.D.C.; Underwood & Co., builders.

Rotherham.—Houses (30), Moorgate Road and Reneville Road; M. F. Moncaster, builder, Herringthorpe Valley Road.

Scarborough.—Houses (98), Barrowcliff estate; borough engineer.

Sheffield.—Houses (132), Hollinsend Road, Mansfield Road; R. Oliver, builder, Hollinsend Road, Gleadless. Five-storey block of offices, Norfolk Row; J. F. Marchinton, architect, 33, Montrose Road, Sheffield. Houses (101), Darnall Road and &c.; H. Haywood. Houses (40), Studfield Hill; J. Copley & Sons, Ltd. Cinema, Burgess Street; New Century Pictures, Ltd. Works and offices, Cotton Mill Row; R. H. Walker & Son, Ltd. School (£85,000); W. Marlow & Sons, Ltd.

Smethwick.—Flats (64), Thimblemill Road (£34,454), for T.C.; Housing, Ltd., builders, Blackheath.

Southport.—Police and fire stations (£118,006); borough engineer.

Staveley.—Houses (114), Eckington Road; Staveley Builders, Ltd., Staveley, near Chesterfield.

Stourbridge.—Shops and houses, Hodge Farm estate; A. M. Griffiths & Son, builders, Thomas Street, Wolverhampton.

Sunderland.—Clothing factory, Pallion; J. Huntley & Sons, builders, Marion Street, Sunderland. Indoor sports and recreation centre for the T.C.; borough engineer. Schools, Grindon, Ford estate and Plains Farm, for the E.C.; education architect.

Sutton Coldfield.—Houses (73), Grange Lane; R. Shaw & Co.

Swansea.—School, Sketty; E. S. Morgan, architect, Guildhall, Swansea.

Tipton.—Houses (277), Gospel Oak estate (£91,700); U.D.C. surveyor.

Uxbridge.—Reconstruction of Premises, Vine Street; W. Eves, architect.

Warrington.—Houses (200), Long Lane estate (£70,000); D. Cooper.

Washington (Co. DURHAM).—Reconstruction of the Regal Cinema; H. Wiles, architect, 658, Durham Road, Gateshead.

Winchester.—Houses (33); R.D.C. surveyor, Ryelands, Hedge End, Southampton.

Witton (PATRICROFT).—Houses (72), Bray Avenue; J. Valentine, Winton Grange, Gee Lane, Eccles.

York.—Houses (42), Forestway estate; Ainstey Estates, Ltd. Houses (74) and flats, Gale Lane estate (£33,500); Sherriff & Co., Ltd. Flats and houses, Dale Street (£16,400); J. F. Stevenson.

Cables for Use in Mines

A British Standard Specification has recently been issued for paper-insulated cables for use in mines with a view to standardising the requirements of the industry and also to comply with the Regulations of the Coal Mines Act regarding conductivity of metallic coverings, &c. Metal-sheathed, paper-insulated cables only are dealt with, and the specification generally follows the lines of B.S.S. No. 480, with the exception of thicknesses of insulation, which are of slightly more robust construction. The specification prescribes the dimensions and the voltage tests for 650, 3,000, 6,000 and 10,000 V cables, and the dimensions for the armouring, serving and bedding are included. Copies of the specification (No. 760-1938) can be obtained from the British Standards Institution, price 2s. 2d. post free.